THE HOUSING MARKET AND REAL ESTATE AGENTS

BY

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL OF THE
UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

MAY 1992

I dedicate this dissertation to my parents Alapati Narasinga Rao and Sugunamani.

ACKNOWLEDGEMENTS

This dissertation could not have been successfully completed without the support and guidance of Professors Edward Zabel and G. S. Maddala. I wish to thank them for their useful comments, insights and faith in me which kept me on track whenever I was faltering. I would also like to thank Professors David Denslow, David Sappington, Lawrence Kenny and Stephen Donald for their invaluable comments and suggestions.

I am also greatly indebted to the illustrious economics faculty at the University of Florida, for contributing in one way or another to my development in the Ph. D. program.

In particular I shall cherish my association with Professor Steven Slutsky whose zeal for teaching and research has inspired me immensely.

I am grateful also to Professor Barton Weitz of the Marketing Department for being on my dissertation committee despite his extremely busy schedule. Many thanks are due to Pam Dampier for helping me with all my wordprocessing needs and to Dian Studstill and Joan Feuston for invaluable office assistance.

Finally, I could not have endured the Ph. D. program without continual support from my family. I thank my parents Narasinga Rao and Sugunamani and Purna Rao and Satyavati and my brother and sister-in-law Surya Rao and Sundari for their support and encouragement throughout my education. I also thank my sisters-in-law Annapurna, Syamala and brother-in-law Ram for their confidence in me. I especially thank my mother-in-law Mahalakshmi for all the support she has given me over the years. Without the patience, understanding and reassurance from my husband Murali, I could not have either

started or successfully concluded my doctorate. Last, but definitely not the least, the very presence of my lovely daughter Vidya kept me going during the final years. It is their pride in me today that is the greatest reward for me.

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Requirements for the Degree of Doctor of Philosophy

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MAY 1992

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This dissertation studies the interaction of buyers, sellers and real estate agents in the housing market. Most of the current work on housing markets has ignored the importance of real estate agents.

Buyers and sellers have incomplete information about each other and the availability of houses. Spatial fixity of houses also implies the lack of an organized "marketplace." The main role of a real estate agent is to provide information and bring buyers and sellers together thus making the market. For these services the realtor is paid a commission. Commission rates have been in the neighborhood of 6% across the United States. This has led to charges of noncompetitive commission rates fixing.

The present thesis disputes the argument of commission rate fixing. In a competitive market with incomplete information characterized by a large number of buyers and sellers with little or no market power, a market maker's ability to charge high prices is limited by the ability of buyers and sellers to trade among themselves. The prices chosen

by the market maker then tend to be very close to the competitive equilibrium prices. This implies here that the observed commission rates are likely to be the competitive rate of return for the real estate agents' services.

I present a theoretical model which considers the sellers, buyers and brokers of housing in an integrated manner. The optimal commission rate set by brokers is shown to be a function of the seller's decision rule for using a broker in selling his house. In deriving this outcome I examine a variety of models and also consider various implications of incomplete information.

I then develop an empirical model that simultaneously estimates the commission rates and probabilities of brokered sales of housing, in 540 housing transactions in fifteen states across the U.S. My hypotheses regarding the commission rate are validated by this model.

CHAPTER I

INTRODUCTION

Expenditures on housing are a large component of household spending. They are also an important economic indicator in a major industrialized economy like the U.S. Despite the obvious importance of the housing market, little attention has been given to an analysis of how this market operates. The focus in this dissertation is the interaction of various agents in the operation of this market. There are three kinds of agents that we will analyze--the seller of a house, the buyer and the real estate agent. Real estate agents provide a variety of services to both the buyers and the sellers of housing and charge a commission rate for their services, usually from the sellers.[1] These services are mainly those of providing information about the available houses, prices, financing and assistance in arranging matches between buyers and sellers. As producers and sellers of information about the housing market, real estate brokers perform the important function of "making the market" for buyers and sellers of housing. This market-making function of brokers has not been given the importance it deserves in the existing literature.

When a seller wants to sell a house, he can do so via two channels--(i) on his own and (ii) through a real estate broker by listing with a brokerage firm. The two channels of sale differ in the costs involved and may differ in the expected time on the market. If

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[1] The buyer may engage a real estate agent and pay him for his services. However, this practice is not common. It is assumed here that seller actually pays the commission.

the seller sells the house himself he has to incur the cost of searching for buyers (e.g. advertising), showing the house to prospective buyers and the cost of holding the house until a sale occurs. If the house is sold through a real estate agent, on the other hand, the seller has to pay the broker a percentage of the sale price of the house as a commission. A rational seller will choose the better alternative.

A buyer searches for a house which meets his requirements at the least price. In this process of search, he too has various options--(i) to go directly to individual sellers, (ii) to use the services of a brokerage firm or (iii) to build a house. Usually a buyer would use both alternatives (i) and (ii) for an already exisiting house since the costs of both alternatives are similar--the time costs of visits to a seller or the broker.

Brokers produce and sell information to sellers and offer this information without charge to buyers of houses and aim to maximize returns from their activities.

The objective of the present dissertation is to critically evaluate the theoretical and empirical work previously done on the housing market and suggest ways in which the analysis would be enriched when the importance of a real estate agent as a market maker is incorporated in the analysis. In doing so an empirical model of the price making behavior in the housing market is developed.

The rest of the dissertation is organized as follows. I describe the operation of the housing market and the role of real estate agents in the next chapter. Chapter III examines the existing literature. In Chapter IV I examine a theoretical model. I develop an empirical model and describe estimation procedures in Chapter V. Data sources and empirical results are discussed in Chapter VI. Finally, I present a summary and conclusions in Chapter VII.

CHAPTER II

OPERATION OF THE HOUSING MARKET

The housing market involves interactions among three types of economic agents--sellers wanting to sell houses, potential buyers and real estate agents who facilitate transactions by providing information about available houses to buyers and about the pool of buyers to sellers. For the function of providing information the broker charges a commission, usually from the seller.

The seller of a house wants to sell his house at a reasonable price with minimum delay. This involves searching for buyers by spending time and money to attract them. A larger number of potential buyers implies a higher probability of getting a better price for any house and a higher probability of attracting a buyer within any time interval. The seller may undertake this search himself or employ the services of a real estate agent. These two channels of search differ in the costs involved and the rational seller would choose the better alternative.

A buyer's objective is to buy a house with a set of characteristics at a minimum price. Thus a buyer searches over the set of available houses in the market. Buyers have the option of getting information from any or all of the following sources--through advertisements, word of mouth or a real estate agent. A buyer may choose a real estate agent along with any of the other alternative sources since in most cases the cost of services of the real estate agent is borne by the seller.

The main function of real estate agents is matching prospective buyers and sellers. This function assumes great importance in the housing market due to several distinguishing characteristics of the commodity being traded which makes the existence of a usual marketplace impossible. These characteristics are (i) fixed locations of houses, (ii) heterogeneity of houses, (iii) durability of houses, (iv) infrequent transactions among buyers and sellers and (v) complexity arising from the financial and legal dimensions of the transactions.

The function of real estate brokers is to collect and maintain information about the prospective supply of and demand for houses. The buyer's search is thus expedited by such availability. This information is useful to the seller in determining (i) whether to sell the house and (ii) the initial asking price. The broker's information facilitates trade among buyers and sellers. There are several benefits of involving a real estate broker in the process of buying or selling a house. First, real estate brokers have more expertise and familiarity with general bargaining and specific real estate transactions. Secondly, they may have the potential ability to mediate differences between principals, which may be more difficult if buyers and sellers try to negotiate directly. Finally, the broker may be able to expedite the transaction by providing guidance and information about the settlement process. For all the important functions listed above, the real estate agent charges a commission, usually from the seller (see Crockett, 1982).

Commission rates charged by the real estate agents are influenced by the characteristics of the market and the resulting behavior of buyers and sellers. From the perspective of both buyers and sellers, the commission rate represents an opportunity cost of obtaining information. Thus the higher the commission rates, the greater the likelihood of sellers choosing to undertake the search for buyers themselves rather than

through an intermediary. High commission rates are also likely to lead buyers to negotiate directly with sellers as they hope to find lower prices than those listed with the broker. Even though the seller technically pays the commission, the incidence may be on the buyer, implying that buyers have some prospect of obtaining a price between the price received by sellers who list with brokers and that paid by buyers. Thus, the ability of buyers and sellers to transact directly among themselves exerts pressure on the commission rates charged by the broker. When choosing commission rates, real estate agents must strike a balance between two opposing forces--i.e. providing a reasonable opportunity costs to buyers and sellers while ensuring a sufficient return on their own investments. Hence, the existence of potential traders outside the real estate agent's activities implies considerable competitive pressure on the choice of commission rates by market-making real estate agents.

The operation of the housing market as described above provides an explanation for the empirical observation that commission rates do not differ much from region to region in the United States. These rates tend to vary only in a small interval around six percent with some variation depending on the price of the house. This apparent uniformity has lead to concerns about price fixing by real estate brokerages and violations of antitrust regulations (People vs. National Association of Realtors, 1981; Owen, 1977; Crockett, 1982; Miller and Shedd, 1979). Several Federal Trade Commission Reports have attributed the observed pricing behavior to the cooperative marketing arrangements by the local multiple listing services (see e.g. FTC, 1984). Some recent studies have disputed this argument of price fixing as there are a large number of competitive brokerage firms each of which do not have the power to fix the commission rate, even though most of these firms belong to a national organization called the National

Association of Realtors (Crockett, 1982). In particular the characteristics of the housing market suggest that it is the competitive pressures exerted by the buyers and sellers who have the ability to transact among themselves, rather than those exerted by other brokers, that lead to near competitive commission rates. Jud (1983) has also observed that real estate agents lack any monopoly power in influencing the sales prices of houses.

The argument that commission rates tend to be competitive, however, does not rule out some variation in commission rates due to differing costs incurred by the real estate agents on different transactions. Commission rates may vary within regions depending on the costs of acquiring information and characteristics of houses. An extensive study covering over 7000 housing transactions in the United States in 1975, 1978 and 1979 was conducted by Carney. He uses an economic search model and various brokerage cost assumptions to derive brokerage pricing implications and argues that relative search cost differences imply that commission rates will be lower on (i) sales of higher-priced homes, (ii) sales of new relative to existing homes and (iii) nonco-op relative to co-op sales[1] (Carney, 1982). Carney's findings are consistent with the argument that commission rates are kept in check due to the competitive pressures because these variations are caused by genuine cost differentials rather than the power a real estate agent possesses as a market maker.

The above explanation of the features of the real estate market is similar in spirit to the analysis of securities exchanges using the specialist system provided by Bradfield and Zabel (1979) and Zabel (1981). The former introduces explicit price making behavior in competitive markets. The specialist in the securities exchange is a price maker (akin

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[1] Co-op sales are those that are conducted through brokerages which are a part of a co-operative organization such as multiple listing services. Henceforth, the term MLS will be used rather than co-op.

to our real estate agent). The existence of such a price making agent challenges the notion that all agents in a competitive market must be price takers. In an extension of this model, Zabel (1981) shows that even though a securities exchange specialist possesses some monopoly power in choosing the spread between the ask and the bid price of stock, this power is restricted by the prospect of traders trading among themselves within the spread. This prospect induces the specialist to reduce the spread to avoid losing sales. Similarly real estate agents' fees are limited by the competition among various brokers and also because sellers and buyers can deal directly with each other.

Despite the similarities between the securities market and the market for real estate, importance differences also exist. The specialist guarantees buy or sell orders since he satisfies excess demand by trading for his own account (i.e. from the inventories he holds or by selling short). Also, in the securities market buyers and sellers do not have to search for each other and the commodity being traded (shares in corporations) is homogeneous. In the housing market the informational and availability aspects are much different. One of the important features of this market is the heterogeneity of the commodity being traded. The characteristics of houses are usually difficult to assess. Another uncertainty is introduced due to the difficulty in determining the availability of buyers and sellers. Thus it is essential to search for information about housing characteristics and buyers and sellers. In most cases there is no buyer or seller of last resort as in this securities market.[2] Real estate agents only provide intermediation between buyers and sellers because holding of inventories in this market is costly and sellers have to bear the cost of holding a house while awaiting a sale.

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[2] More and more companies are trying to serve this function e.g. ERA real estate firm guarantees to buy an unsold house that is listed with them under some restrictions. However, this practice is not yet widespread.

Thus, in the real estate markets while competition leads to some uniformity in commission rates across regions, characteristics of regional markets affect the decisions of buyers and sellers in regard to trading outside the market or with real estate agents. One of the important characteristics of the market which determines whether buyers and sellers trade among themselves or through real estate agents is whether the market is active or inactive. In a market with a large number of buyers, i.e., an active market, the likelihood of a seller finding an interested buyer is high and thus the cost of searching for buyers would be relatively low. Thus the probability that a seller would list with a real estate agent would be low. To a buyer the active market would thus indicate a situation where negotiating directly with the seller or seeking the services of a broker may be equally attractive. In an inactive market, however, the number of buyers is small compared to the number of houses available thus requiring sellers to expend a considerable amount of time and money in finding a prospective buyer. Thus the likelihood of sellers engaging the services of a broker in such a market will be relatively high.

Since housing is an infrequently traded commodity and buyers and sellers do not have the advantage of extensive experience, they might revise their decision about trading with the help of real estate agents. Initially, a seller may attempt to sell a house without intermediation but, as the burden of holding a house increases, may later shift to a brokerage listing. Thus a seller's behavior has a dynamic element attached to it. Similarly, buyers too may need to revise their decision to approach a broker after they have entered the market.

From the above discussion it is evident that any analysis of housing markets must take the role of real estate agents explicitly into consideration. Yet an examination of the

prior work in this area reveals that either the relationship between agents (i.e. sellers, buyers and brokers) has been completely ignored, or modeled very inadequately. In the next chapter I examine and review existing literature on theoretical as well as empirical issues in this area.

CHAPTER III

LITERATURE REVIEW

In this chapter I give a broad overview of research on the housing market. In the next chapter and in Chapter V I consider some of the studies most relevant to my research in more detail.

A recent survey of economic models of the housing market by Smith, Rosen and Fallis (1988) suggests a shortage of analytical and empirical work incorporating the extremely important role played by real estate agents in the market for housing. The literature on models of the housing markets is divided according to which of the several special features of housing are emphasized. These special characteristics of housing are: heterogeneity, durability, spatial fixity and the extensive government involvement in the housing sector. As it is almost impossible to build a realistic economic model incorporating all these features, each strand of the literature deals with one or the other. However, models are now becoming more general and thus many of these strands overlap.

Some of the earliest economic models started out ignoring most of the special characteristics of the housing market (Muth 1960; Olsen 1969) by assuming the existence of an unobserved commodity called housing service which takes care of the heterogeneity feature. Further, these studies dismiss any problems involving durability of housing by assuming that a unit of this housing service is equal to a unit of housing stock per unit time with perfect capital markets and no taxes and asset market equilibrium (see, e.g.,

Deaton and Muellbauer, 1980). These models also ignored intertemporal and spatial issues. Questions of interest were: How does an increase in income affect the price of housing services? How do increases in prices of building materials affect housing output and prices? Early empirical models mainly study the estimation of price and income elasticities of demand for housing and the production function on the supply side. (de Leeuw 1971, Quigley 1979 and Mayo 1981 survey demand side issues; supply side issues are discussed by Muth 1960, de Leeuw and Ekanem 1971, Arnott and Griesen 1983 and Bruce Smith 1983. McDonald 1981 and Edelstien 1983 survey the literature on production functions.)

Starting from these simple models several modifications are introduced to make the analysis more realistic and to study some of the special features of housing. Introducing durability in these basic models makes the distinction between housing stock and housing services important. Durability is introduced into the simple models of housing explicitly by assuming that the market adjusts in a stock-flow manner. These models assume that the short-run supply of housing stock is perfectly inelastic. Then it is the demand for housing that determines the equilibrium price in this market. (See Duesenberry 1958; Muth 1960; Lawrence Smith 1969; and Olsen 1969 for a discussion of the stock-flow models of housing.) Similar stock-flow models were also used in macroeconomic models of the housing market. These are surveyed by Grebler and Maisel (1963), Fair (1972) and Fromm (1973). Durability of housing also presents an explanation for tenure choice, i.e. choice between renting and owning a house, as markets for housing stock (i.e. ownership) and for housing services (rental market) now become different from each other. The existence of tenure choice implies that demand

analyses must now consider discrete choice of owning or renting as well as the continuous choice of quantity.

Empirical analyses including durability mainly involve estimating expected user cost of housing which are used to test hypotheses about tenure choice (e.g., Douglas Diamond 1980). The durability issue also focuses on the production process for housing services, i.e., owning a house implies home production of housing services and renting implies buying these services in the market (Weiss 1978).

Spatial fixity is another important attribute of housing which has received extensive attention in the urban and regional economics literature as it has important implications in studying effects of race and racial discrimination in urban housing markets. The analysis of housing demand in this case includes location in the utility function. Utility maximizing households must choose location as well as quantity of housing. The models involving location choice issues are surveyed by McDonald (1979), Wheaton (1979) and Henderson (1985).

Heterogeneity of housing deters formation of an organized commodity market since accurate price-characteristics information is not readily available in this market. Information gathering involves expensive search on the part of buyers and sellers of housing, thus making real estate agents central to this market. However adequate attention has not been paid to this information generating function of real estate agents in the housing market.

The surveys by Smith, Rosen and Fallis (1988) and by Muth and Goodman (1989) seem to suggest that studies which deal with the economics of housing markets do not emphasize the important role of real estate agents. There is another stream of work dealing with issues in real estate which studies real estate brokerage markets. In fact, it

has become customary to distinguish a housing market which deals with the demand for and supply of housing and a brokerage market which deals exclusively with the demand for and supply of brokerage services with little concern for the interaction of these markets.

Zumpano and Hooks (1988) survey theoretical and empirical models on the market for real estate brokerage services. They present and critically evaluate past studies which attempt to explain the structure and performance of this market. Much of the research has sought to justify or challenge certain popular observations about this market. It has been charged that this market is inefficient, that it is monopolistic and most importantly that local multiple listing services lead to little competition and hence too high commission rates. Even this literature surveyed here does not provide any formal treatment of the alternative methods of search for individual buyers and sellers in the market for real estate.

One of the first theoretical models of real estate broker behavior was developed by Yinger (1981). The primary goal of this study was to promote an understanding of the market for real estate broker services under uncertainty. He formulates the problem as one of broker's search for buyers and sellers in order to maximize his income. Income is derived by the broker as a commission for successfully making a match (i.e., succeeding in making a sale). Yinger derives equilibrium amounts of search, the commission rate and the expected number of matches through partial equilibrium analysis and suggests comparative static exercises for changes in the equilibrium values. He looks at the effects of MLS on the variables of interest and studies the welfare and policy implications of his analysis.

Among other conclusions, considering the entry of brokers, Yinger argues that entry shifts the supply of listings downwards and raises the commission rate. In comparing the system with and without MLS, he concludes that MLS increases the average housing price, decreases resources devoted to broker search and increases brokers' income but that the effect on the commission rate is ambiguous. Finally, he concludes that there may be substantial welfare gains from government intervention in this market.

Recent work by DeBrock (1988, 1989) is also a theoretical analysis of the market for broker services. As in Yinger's study, DeBrock does not allow direct sales between buyers and sellers. In contrast to Yinger, DeBrock considers interaction among brokers to be a non-cooperative game. He considers a two-stage game in which prices are set in the first period and marketing effort occurs in the second period.

He demonstrates that under MLS the Bertrand-Nash outcome is that the prices of houses are bid up (possibly to the monopoly level) and not down to cost (this conclusion is exactly the opposite of the usual Bertrand-Nash outcome). He also shows that MLS leads to an unambiguous increase in commissions and an increase in the pricing of houses with a decrease in the return to the house owner. From the point of view of efficiency, he states that the MLS system may attract too much or too little co-brokerage efforts thus leading to lower than maximum industry profits. Thus he concludes that the general notion that MLS is a beneficial institution in the housing market, from the point of view of increased information, is incorrect in that other effects negate this positive one.

In contrast to Yinger and DeBrock, Wu and Colwell (1986) introduce direct exchanges between sellers and buyers as well as transactions with real estate brokers as intermediaries. They analyse the equilibrium in each market separately (partial

equilibrium) and simultaneously (general equilibrium). For example, considering partial equilibrium in the housing market, an increase in the commission rate has no effect on total housing supply but reduces the quantity and price of housing. In the general equilibrium analysis an increase in the cost of search for listings decreases the commission rate but the effect on the price of housing is inconclusive. Similarly, an increase in the cost of search for buyers decreases the price of housing with an inconclusive effect on the commission rate.

In their analysis, they conclude that an MLS brokerage system will increase the price of housing, and, like Yinger, they too conclude that the effect of MLS on commission rates is ambiguous. Contrary to Yinger, Wu and Colwell conclude that with MLS each broker will devote more resources to search than an independent broker.

Most of the claims by Yinger, DeBrock and Wu and Colwell, some conflicting, have not been subjected to empirical testing. However, whatever empirical evidence does exist in this area does not corroborate any of the claims made by them (Jud, 1983; Carney, 1982). More perspective on these models is presented in the next section which provides a model directly incorporating interaction among buyers, sellers and real estate agents.

On the empirical side, there have been only two studies which have explicitly included the importance of real estate agents in the housing market. The main emphasis of the study by Carney (1982) is to derive implications for brokerage pricing under various cost assumptions. He describes a search model showing a relation between the search and the expected maximum price for a house, but he does not provide a formal analysis of the model. He argues that the maximum price that a seller can obtain increases at a decreasing rate with the time spent on search, since with longer search, he would find a buyer who would be willing to pay more for the property, but at a decreasing rate. He

also argues that commission rates will decrease with mean home price, increase with variance in home prices and decrease with the cost of search.

Empirical evidence is presented to corroborate the above observations and it is found that commission rates are lower on (i) higher priced houses, (ii) on sales of new relative to existing homes and (iii) on non-MLS (or, co-op as he refers to them) relative to MLS sales. To obtain these results, he regressed commission rates on prices of houses and on dummy variables for households (as a proxy for existing versus new homes) and for MLS sales.

The second empirical study which appears in the current stream of literature is one by Jud (1983). He develops a model of demand for broker services by both sellers and buyers of housing. The basic idea is that the seller's demand for brokerage services is a negative function of commission rates and a positive function of transaction costs and the price of the house. The demand for broker services by buyers is similarly a negative function of existing stock of market information and a positive function of the opportunity cost of time. The probability that a seller will decide to employ a broker and the probability that a buyer will choose to buy with the help of a broker are then estimated. Both transaction costs and the sale price were found to be significant in predicting the probability of seller employing a broker. The results on the probability of buyers transacting through brokers were more ambiguous than those on seller probabilities with income being taken as a measure of buyer's opportunity cost of time. As to market information, new buyers were considered as dummy variables and they are expected to have less information than experienced buyers, and resident buyers who buy the house in the same area where they have been living are expected to have more information than those living outside. In Jud's analysis, only the latter was found to be significant.

Another finding is that listing with brokers was not statistically significant in explaining variations in prices, thus suggesting that brokers do not possess any special monopolistic advantage which enables them to extract more for a house (thus getting a higher commission) than if it were sold by the seller himself.

CHAPTER IV

THEORETICAL MODEL

In this chapter I present an integrated model of seller, buyer and broker behavior which captures the essential features of the housing market as described in the previous sections. Before setting-up the model, however, it is appropriate to examine existing work in this area. As mentioned earlier, there are very few studies incorporating the importance of real estate brokers in the housing market.

Review of Theoretical Models

In a pioneering paper, Yinger (1981) studied the "search and match" behavior of real estate brokers in the housing market. In this model, brokers face three types of uncertainty about (i) the number of buyers in the market (ii) available listings and (iii) matches between buyers and sellers. In formulating the problem, he makes the following assumptions:

(1) Brokers try to influence the average price of housing but not the distribution of housing prices. The average price becomes a choice variable in that the probability that a buyer will accept the asking price is a function of the average price.

(2) Brokers consider each time period to be homogeneous in that the number of buyers and sellers in the system is the same in each time period.

According to Yinger both of these assumptions imply that there are no bargains or overpriced houses in some time periods and each buyer and seller encounters the same prospects in each period.

The broker's income comes from the commission payments made for his services. Traditionally, the commission is a percentage of the sale price of the house and in Yinger's model the commission rate is also a choice variable. Clearly, for such a broker, the larger the number of customers, the larger is the expected income. However, the broker has to incur costs to attract customers. Thus the objective of the broker is to maximize the expected income net of the costs of search. The choice variables are, then, the commission rate, the average value of the house and units of search levels for buyers and sellers of housing. Yinger abstracts from dynamic considerations, resorting to common demand and supply static analyses focussing on market clearing choice variables. Characteristics of demand and supply functions derive from probabilistic analysis of interaction of buyers and sellers and various assumptions about demand and supply behavior. For example, the probability δ that a buyer will accept the asking price is a diminishing function of the average price of housing. However, the paper does not distinguish buyers and sellers who arrange trades without using the broker's intermediation. Thus, all sellers and buyers use the intermediation services of a broker.

In a market without a multiple listing service (MLS), a single broker maximizes expected income Y, where

$$Y=(cV-\sigma)N_B P_B[1-(1-\delta P_L)^{N_L}]-r_B S_B-r_L S_L-T_B P_B N_B\ ,$$

with respect to the commission rate c, the average price of housing V, units of search for buyers S_B and the units of search for listings S_L. Here σ is the cost of completing a match, N_B is the known flow of buyers through the system, P_B is the probability of

attracting a buyer, P_L is the probability of attracting a listing, N_L is the number of listings in the system, r_B is the price of a unit of search for buyers, r_L is the price of a unit of search for listings and T_B is the showing cost per buyer. The term in brackets $[1-(1-\delta P_L)^{N_L}]$ is the probability that the broker can match a buyer with a listing in the system.

Yinger then examines the equality first order conditions to determine the characteristics of the system. He does not explicitly consider circumstances causing competitive or noncompetitive outcomes, but does make the following distinction. If the market for broker services is competitive and it is not costly for sellers of housing to find buyers, the $(\partial P_L/\partial c)$ is negative infinity and the broker accepts the market-determined commission. Also, if the housing market is competitive, and it is not costly for buyers to find houses, then, $(\partial\delta/\partial V)$ is negative infinity and the broker has no influence on the price of housing. Moreover, he also claims that high search costs for the seller of housing can generate market power for brokers but does not demonstrate how this result occurs.

In the event the market is competitive, outcomes are determined by equality of demand and supply functions for matches in conjunction with first order conditions. It is difficult to summarize outcomes since Yinger derives results under a variety of assumptions. For example, with simplified assumptions, the supply curve of listings is downward sloping with respect to the commission rate and is independent of the variables r_B, r_L and σ. Considering entry of brokers, Yinger argues that entry shifts the supply of listings downward and raises the equilibrium commission.

Yinger next considers an MLS system where a broker makes matches with his own listings or other broker's listings in which commissions are then shared. Without providing the details here, I note that Yinger offers a variety of conclusions in comparing the system with and without MLS. The quantity of matches does not change. Whether

the commission rate remains the same is ambiguous, but if brokers have market power, MLS will increase V. With or without entry, fewer resources are devoted to search with an MLS than without one and, taking into account other considerations (e.g. an increase in the average housing price), MLS boosts brokers' income. Hence, brokers who set up an MLS have a strong economic incentive to keep other brokers out of it. With additional assumptions he draws some conclusions about the share of a commission a broker receives for matching another brokers listing. For example, if P_L is more heavily influenced by experience and prestige than P_B, then established brokers prefer a lower value of this share than new brokers.

With regard to public policy Yinger argues that his analysis suggests that the optimal level of broker search is less than the level generated by a system with no MLS or even an unregulated MLS. Citing arguments by Stigler (1961) that competition should lead to price variation, a finding by Owen and Grunfest (1977) about uniformity of commission rates in California, and price fixing cases brought against real estate brokers, Yinger also claims that this evidence implies that brokers have considerable market power. Hence, because MLS reduces search relative to the non-MLS system, government should encourage an MLS system, accompanied by vigorous enforcement of anti-trust laws to prevent market power. Yinger concludes by stating that his paper suggests that the welfare gain from government intervention in the market for real estate broker service could be substantial.

In contrast to Yinger, Wu and Colwell (1986) introduce direct exchanges between sellers and buyers as well as transactions with real estate brokers as intermediaries. Direct exchanges occur in the market of direct transactions. Two other markets are also introduced. The housing market determines the equilibrium quantitiy and price of

housing. The real estate brokerage market determines the equilibrium commission rate. Equilibrium in these two markets residually determines equilibrium in the market of direct transaction. Circumstances which determine whether buyers and sellers trade in the brokerage market or the market of direct transactions are not considered.

In analyzing the brokerage market Yinger and Wu and Colwell make a number of similar assumptions. Major difference in assumptions concern characteristics of housing and housing prices and choice variables. Wu and Colwell assume houses are homogeneous with sellers' asking prices specified by some probability distribution. Brokers do not choose the average price of a house or the commission rate. The only choice variables are units of search for listings and buyers. In the Wu and Colwell notation, without MLS, the ith brokers profit function becomes

$$\pi_i = (c\bar{V} - \sigma)N_b P_{bi}[1-(1-\delta)^{N_{li}}] - r_b S_{bi} - r_l S_{li} - t_b P_{bi} N_b$$

Most variables have the same definition as in the Yinger model. Here δ is the probability of matching a buyer with a seller and is equivalent to δP_L in the Yinger equation. A major difference is the interpretation of $\bar{V}$ which is now a parameter given to the broker. Here, $\bar{V}$ is the expected selling price per housing unit with broker intermediation. The expected selling price is related to an expected price determined in buyer search for low housing prices. According to Wu and Colwell, $\bar{V}$ may or may not equal this expected search price depending on whether buyers only search in the brokerage market, search only in the direct transaction market or search in both. If $\bar{V}$ does not equal this expected price the determination of $\bar{V}$ is not explained. A similar problem arises in the owner-seller objective function. The objective function π_i is maximized with respect to S_{bi} and S_{li} where the equality first order conditions have the usual interpretation of equating marginal returns and marginal costs.

In the market for direct transactions the jth owner-seller maximizes the net price of a house by choosing the optimal search for buyers in the objective function

$$\pi_j' = (\bar{V}' - \sigma')P_{bj}'N_b\delta - r_bS_{bj}' - t_bP_{bj}'N_b$$

where the primes on variables distinguish owner-seller variables from broker's variables. In particular, $\bar{V}'$ is the expected selling price per housing unit with owner-seller transactions and, once more, equality first order conditions equate appropriate marginal returns and marginal costs. The buyer's optimization problem is a key element in the analysis since, as noted, this problem determines an expected minimum price which either equals $\bar{V}$ or $\bar{V}'$ or is somehow related to these parameters. The buyer uses Stigler (1961) search with recall. The buyer visits a number of houses for sale and then chooses to purchase the house with lowest observed price. The optimal number of visits is determined by equating the marginal return to search and of a marginal cost to search. That is, the buyer equates the reduction in the expected minimum price by one more search to the cost of visiting a house, obtaining an optimal sample size, the number of houses to visit. The details of the problem are well known and need not be repeated. The nonoptimality of Stigler optimal sample size search is also well known, being dominated by sequential search in which a buyer visits houses until a price is observed which equals or is less than a reservation price determined in the analysis of search. However, correcting the Wu and Colwell model to introduce sequential search would not change qualitative outcomes in the model. The parameters $\bar{V}$ and $\bar{V}'$ would now be related to an expected minimum price determined by sequential search.

Wu and Colwell then complete their analysis by an examination of partial general equilibria. Considering partial equilibrium in the housing market, an increase in the commission rate has no effect on total housing supply but reduces the quantity and price

of housing. In the general equilibrium analysis an increase in the cost of search for listings decreases the commission rate, but the effect on the price of housing is inconclusive. Similarly, an increase in the cost of search for buyers decreases the price of housing with an inconclusive effect on the commission rate.

In an analysis similar to Yinger's, Wu and Colwell consider the system with MLS. With MLS, the partial equilibrium price of housing is higher and the commission rate is lower. However, in the general equilibrium analysis the effect on the commission rate is inconclusive. In analyzing the ratio of the split between the brokers, using various extreme assumptions, they argue that the split would be close to, but higher than, than the equal split observed in most real estate markets. In comparing search levels, Wu and Colwell conclude, contrary to Yinger's results, that, under MLS each broker will devote more resources to search than an independent broker. They also conclude that with MLS the price of housing is higher and the level of search by owner-seller is greater. Wu and Colwell refrain from drawing conclusions about public policy issues.

The papers by DeBrock (1988, 1989) are similar to Yinger's study in that direct sales between buyers and sellers are not allowed. But, whereas Yinger uses competitive marginal analysis and comparative statics to obtain outcomes, DeBrock considers interactions among brokers to be a non-cooperative game. DeBrock also explicitly allows dynamic elements of the trading process by considering probabilistic features of the time it takes to sell a house. We consider outcomes in his second paper which is a revision and extension of the first paper.

As do other authors, DeBrock considers the brokerage system with and without MLS, with emphasis on the MLS procedure. In both cases he assumes the housing market is competitive with the supply curve for houses being perfectly elastic at a price of $\bar{P}$ dollars.

Real estate agents buy houses from sellers at the price $\bar{P}$ and then resell houses to buyers at the full price $\rho_i = (1+p_i)\bar{P}$ where p_i is the commission rate. Hence $\rho_i - \bar{P} = p_i\bar{P}$ gives the commission income on the sale of a house. Each agent also invests an amount of marketing expenditure m_i per house at time $t = 0$.

In the system without MLS, m_i is assumed fixed, so that an agent's only decision variable is the commission rate p_i which is chosen to maximize discounted expected profit on sales. Without MLS the objective function for the ith agent is then

$$V_i = \int_0^\infty (\rho_i - c_i - \bar{P}) q_i(\rho_i, \underline{\rho}_j) h(t,m) e^{-rt} dt - m_i q_i(\rho_i, \underline{\rho}_j) - F_i$$

where c_i is the fixed closing cost per sale, $q_i(\rho_i, \underline{\rho}_j)$ is buyers' demand for houses listed with agent i, which depends on own price ρ_i and the vector of prices of rival sellers $\underline{\rho}_j$, h(t, m) is the density function of time to sale where h diminishes with increases in marketing expenditure m, r is the discount rate and F_i is a fixed cost. Seeking a noncooperative Nash solution in prices, DeBrock asserts that one can derive the common non-cooperative equilibrium prices ρ_i^*.

In the MLS system with joint marketing DeBrock poses the problem as a two-stage game. In stage one an agent chooses the price ρ_i and in stage two the marketing level m_i. He assumes an equal split in the event an agent, who is not the listing agent, sells the house. Later in the paper he considers non-equal splits. The objective function is now modified to take into account the split and probabilities of a listing being sold by rival agents. For the ith agent the objective function becomes

$$V_{MLS} = \int_0^{\infty} (\rho_i - c_i - \bar{P}) q_i h(t,m)(1 - H(t,m))^{K-1}\, e^{-rt} dt \; - \; mq_i \; - \; \hat{F}$$
$$+ \int_0^{\infty} \frac{1}{2}(\rho_i - c_j - \bar{P}) q_i (K-1) h(t,m)(1 - H(t,m))^{K-1} e^{-rt} dt$$

Here $(1 - H(t,m))^{K-1}$ is the probability that the K-1 rivals will not sell an agent i listing by time t where H is the distribution function associated with the density h. Here $\hat{F} > F_i$ includes fixed cost of membership in the MLS.

To obtain a non-cooperative solution to this problem and to compare the outcome with the system without MLS, DeBrock (1989) assumes all agents are identical, the density function h is exponential and the demands q_i are quadratic. He then shows that the equilibrium commission rate is larger in the MLS system, i.e., $p_M^* > p_I^*$ where M represents the MLS system and I the non MLS (independent) system. Moreover, MLS agents' profits increase relative to the system without MLS. DeBrock also compares the MLS non-cooperative system to the MLS collusive system where agents jointly maximize industry profit. Outcomes depend on the parameter values. According to DeBrock, there exist a wide range of parameter values under which an MLS would price above the collusive price level. Moreover, MLS may lead to over-marketing or under-marketing relative to the collusive outcome. In considering the choice of a split variable he argues that the outcome is also parameter dependent. Finally, DeBrock briefly considers cases where the supply function of houses is upward sloping and a case in which houses are supplied by a monopolist. Again, results are parameter dependent. However, to consider a case of monopolistic supply of houses which contradicts facts in the real world does not seem to be a fruitful exercise.

Model Description and Specification

Introduction

The model to be developed focuses on the interaction between owner-sellers and real estate brokers. Yinger and DeBrock ignore the possibility that sellers may attempt to market their own houses, and Wu and Colwell only assume the separate existence of owner-seller and real estate brokerage markets without explicitly considering the interaction of these markets.

Rather than distinguishing the housing market, the brokerage market and market of direct transactions (as in Wu and Colwell's paper), which has become common in the literature on housing, the emphasis here is that there is a housing market in which transactions are arranged either by direct interactions between sellers and buyers or by brokers acting as intermediaries. In this perspective the housing market incorporates strong purely competitive features. There exists a large stock of houses, of various ages and characteristics, individually owned, a fraction of which are available for resale. The home building industry consists of many builders with little impediment to entry. Hence, housing prices, both new and old, tend to be competitively priced. The earlier empirical literature, as discussed in Chapter III, which ignored marketing of houses, emphasized the competitive structure of the housing market. Given the strong competitive feature of the housing market, methods by which houses are bought and sold would affect housing prices mainly through the spread between ask and bid prices, that is, between the prices paid by buyers and the prices received by sellers. In transactions with brokers the commission represents the major part of the difference between the ask and bid prices and in direct transactions between sellers and buyers various search costs constitute the major part of the spread. Closing costs are the other common element. A major issue

in the housing market, then, is whether the commission rates are determined competitively or noncompetitively, as attested by numerous antitrust suits against brokerage firms. This issue is not directly studied by Yinger and Wu and Colwell, though Yinger, nevertheless, concludes that the evidence implies that brokers have considerable market power and encourages vigorous enforcement of antitrust laws to prevent market power. Using game theoretic analysis of brokerage firms, DeBrock qualifies his results, but does emphasize noncompetitive outcomes among brokerage firms and specifies conditions under which the equilibrium price that arises under MLS would be higher than the price that a monopolistic (cooperative) brokerage market would charge, even though the individual brokers act noncooperatively under MLS.

Specification of the Model with a Single Broker

Specification of the model with identical sellers

The housing market is characterized by several classes of houses with various characteristics. Housing prices reflect not only the class of houses but regional differences such as land prices, labor costs and differential market activity, generally affecting regional demand and supply of houses. However, since the emphasis here is the spread between ask and bid price as determined by interaction among sellers, buyers and brokers, I assume, as does DeBrock, that there is a single class of houses with a given competitively determined price $\bar{P}$.

A second major assumption is the heterogeneity of houses, even though the houses have the same listing price. Houses have different characteristics due to location, state of repair, arrangement of rooms, exterior building material, landscaping and other features. Without heterogeneity, search is greatly simplified, in particular, there is then no reason for buyers to visit a house, and the need for brokers is diminished.

As do other authors, I assume that brokers receive a commission ρ for their services, as is customary in the real world. I do not attempt to explain this method of payment, other than to note that the use of a commission rate has some support in the principle-agent literature (e.g., Harris and Raviv, 1979). Since sellers cannot directly monitor the broker's activities, payment linked to success provides an incentive for brokers to consummate sales.

I assume as does Yinger explicitly and DeBrock implicitly that the number of sellers and buyers (M, N) remains the same in each period. Hence sellers and buyers consummating sales in a period are replaced next period to maintain (M, N) constant.

Initially it is assumed that sellers have identical costs even though they may be selling houses with differing characteristics and there exists a single broker. Hence, if one seller decides to list (or not) with the broker, the others will also do the same. Thus, I wish to compare a situation where all sellers list with the broker or none list with the broker. Thus, when sellers do not list with the broker, all buyers only visit owner-sellers, and when all list with the broker all buyers only visit the broker. The object then is to determine a broker commission rate which will induce all sellers to list with the broker.

I assume both sellers and brokers wish to maximize the expected return over an indefinite horizon. First, the random process for an owner-seller is considered. Suppose an indefinite horizon is divided into discrete time periods, say, a week. Potential buyers visit the house randomly during the week. Let λ be the expected arrival rate of buyers per week. Moreover, suppose a fraction p of these buyers offer to purchase the house. Then the expected number of offers per week is λp.

Initially, to provide perspective on the problem, I assume that the random process is Poisson, a process which seems to provide a good approximation of numerous

situations involving random arrival rates (Parzen, 1960 and Ross, 1972). If P(k) is the probability that k buyers arrive and make offers during the week, then

$$P(k) = e^{-\lambda p}\frac{(\lambda p)^k}{k!}; \quad k = 0,1,2,... \qquad (1)$$

Then $P(0) = e^{-\lambda p}$ is the probability that no offers are made during the week. Since 1-P(0) is the probability that one or more offers will be made during the week and since the owner-seller would accept any offer, the relevant probabilities for the owner-seller are P(0) and 1 - P(0). In this framework, P(0) represents a failure and 1 - P(0) a success for the owner-seller. Then, the probability for a first success in period t would be

$$[P(0)^{t-1}.(1-P(0))] = [e^{-(t-1)\lambda p}.(1-e^{-\lambda p})] = (e^{\lambda p}-1)e^{-\lambda pt} \qquad (2)$$

which is the probability of failure in the first t-1 periods times the probability of success in period t.

In a more general framework, F(t,m,M,N) would represent the probability of a first success in period t, indicating the dependence of F on marketing expense m and (M,N) the number of sellers and buyers in the market. It would be reasonable to assume that the sum of these probabilities, over any finite number of initial periods, would increase with an increase in m and N, and decrease with an increase in M (and, of course, the sum of these changes would go to zero as the number of initial periods goes to infinity). In Appendix A it is shown that, in the Poisson process, this outcome is obtained if $d(\lambda p)/dm > 0$, $d(\lambda p)/dN > 0$ and $d(\lambda p)/dM < 0$, which are reasonable assumptions.

In formulating the seller's problem of maximizing the expected return in the sale of a house, the expected time of sale, or, equivalently, the expected time of a first offer, is an important component of the problem. In terms of the Poisson process, the expected time of a first offer E(t) equals

$$E(t) = (e^{\lambda p} - 1)\sum_{1}^{\infty} t e^{-\lambda p t}. \qquad (3)$$

Using the properties of infinite sequences, it easily follows that $E(t) = 1/(1 - e^{-\lambda p})$.[1] However, in a general framework, such a convenient expression would not be available.

In the Poisson case, given the assumptions $d(\lambda p)/dm > 0$, $d(\lambda p)/dN > 0$ and $d(\lambda p)/dM < 0$, it then follows that the expected time on the market E(t) diminishes as m and N increase and increases as M increases. Given the assumption about F(t,m,M,N) in the general case, the expected time on the market has the same properties as in the Poisson case.

<u>Owner-seller's problem</u>

The owner-seller's problem, then, is to maximize the net expected value of the house over an indefinite horizon. The sale price of the house is assumed to be fixed by the competitive forces in this market. The owner-seller also incurs various costs. These costs are:

m Marketing costs per period to attract buyers, e.g., advertising in the local newspaper.

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[1] The outcome described by E(t) is analogous to a similar result obtained in the continuous time exponential process where the distribution function $G(t) = 1 - e^{-\lambda pt}$ and the density function $g(t) = \lambda p e^{-\lambda pt}$ for $t \geq 0$. Here, the expected value, say, $\bar{E}(t)$ equals

$$\bar{E}(t) = \lambda p \int_{0}^{\infty} t e^{-\lambda p t} dt = 1/\lambda p$$

Noting that $(e^{\lambda p}-1) > \lambda p$, with $(e^{\lambda p}-1) \approx \lambda p$ for small λp, it is apparent that the process $(e^{\lambda p}-1)e^{-\lambda pt}$ describing the arrival of offers is a discrete time analogue of the continuous time exponential process. Moreover, it easily follows that $E(t) > \bar{E}(t)$.

h Holding costs per period. Maintenance expense, interest and user cost of house as an asset. Holding costs strongly depend on whether the owner lives in the house, the house is rented or it is vacant during time on the market.

s Showing cost per prospective buyer. This is the opportunity cost of a visit to the house by an interested buyer. The expected cost per period is λs.

c Closing costs.

D Fixed costs. These are the costs of preparation of the house for sale.

For the owner-seller the net expected value is then given by

$$V = \sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m + h + \lambda s)\sigma_t]F(t, m, M, N) - D \qquad (4)$$

where β is the discount factor and $\sigma_t = (1\text{-}\beta^t)/(1\text{-}\beta)(\beta^{t-1})$.

When the seller decides to sell the house through a broker, the costs that need to be incurred are different. The advertising and other related costs are now borne by the broker. Therefore m need not be spent by the seller. The seller also need not incur showing costs, since now that is the responsibility of the broker. However, the holding cost until the sale is finalised is still the responsibility of the seller. Similarly, the closing costs and the fixed costs are also the obligation of the seller. For the services of the broker, the seller needs to pay him $\rho\bar{P}$ upon completion of the sale, where ρ is the commission rate. The net expected value to the seller in this case is then

$$V_b = \sum_1^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - c - h\sigma_t] F_b(t, m_b, M, N) - D \qquad (5)$$

where $F_b(t,m_b,M,N)$ is the probability of a first success in period t if the property were sold by the broker. Here, we distinguish between the marketing cost for the broker and the owner-seller. Thus the property will be listed with the broker if $V_b \geq V$, i.e.,

$$\sum_1^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - c - h\sigma_t] F_b(t, m_b, M, N) \geq$$
$$\sum_1^{\infty} \beta^{t-1}[\bar{P} - c - (m+h+\lambda s)\sigma_t] F(t, m, M, N) \qquad (6)$$

If $F_b = F$ then the constraint reduces to

$$\sum_1^{\infty} \beta^{t-1}[\rho\bar{P} - (m+\lambda s)\sigma_t] F \leq 0 \qquad (7)$$

<u>Broker's problem</u>

The broker considers (M,N), the numbers of sellers and buyers in the market, given the assumed renewal properties, to be the same in each period. In each period, for each house there is a probability of no offers in each period (i.e., a failure), $P_b(0)$, and a probability of a success, $1\text{-}P_b(0)$, allowing for the possibility that probabilities for the broker and owner-seller may differ. Then the process of selling houses in each period is described by the binomial distribution. Hence, the expected number of houses sold each period equals M times the probability of sucess or $M(1\text{-}P_b(0))$, recalling that $P_b(0)$ depends on (M,N).

In the general framework, note that $(1\text{-}P_b(0)) = F_b(1,m_b,M,N)$, the probability of a first success in period 1. Then the expected number of houses sold each period is $MF_b(1,m_b,M,N)$.

In selling houses, the broker incurs various costs. These costs are

m_b Marketing expenditures per period to generate listings and to attract buyers.

s_b Showing costs per prospective buyer per house. The expected showing cost per house for the broker is $\lambda_b s_b$ where λ_b is the number of expected buyers visiting the broker per period per house.

D_b Fixed costs in establishing a real estate agency.

The objective of the broker is to maximize the net expected profit from selling houses, subject to the constraint that any seller would use the broker only if $V_b \geq V$. This problem can be written as

$$\bar{V} = \sum_{1}^{\infty} \beta^{t-1}[\rho\bar{P} - \lambda_b s_b] MF_b(1, m_b, M, N) - \sum_{1}^{\infty} \beta^{t-1} m_b - D_b \qquad (8)$$

subject to

$$\begin{aligned} &\sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - c - h\sigma_t] F_b(t, m_b, M, N) \geq \\ &\sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m + h + \lambda s)\sigma_t] F(t, m, M, N) \end{aligned} \qquad (9)$$

where the choice variables are the commission rate and the marketing rate (ρ, m_b). The constraint (9) does allow some variation in ρ depending on the choice of m_b. An increase in m_b would decrease the expected time to sale and would allow an increase in ρ. Nevertheless, the constraint (9) limits the choice of the commission rate. Hence, the constraint on ρ, imposed by a seller's option of selling directly to buyers, induces a competitive outcome in this market, even with a single real estate agency, since a seller cannot increase the expected net value of the house by negotiating directly with buyers. The outcome here is analogous to the outcome in a securities market. The single price-

maker for a security, the specialist, chooses the spread, the difference between the ask and bid prices. However, the traders are not obligated to use the services of the specialist. Thus, if the spread is sufficiently large, traders may arrange mutually beneficial exchanges among themselves inside the spread. This prospect induces the specialist to reduce the spread to avoid losing sales. In the real estate market, with the constraint on the choice of the commission rate, sellers are not able to arrange mutually beneficial exchanges with buyers inside the "spread", the difference between the ask price of $\bar{P}$ and the bid price $(1-\rho)\bar{P}$. The specialist would welcome a rule which requires all traders to arrange exchanges at the ask and bid prices he calls, for then he could exploit his monopoly power, as a single price-maker, in the choice of the spread. Similarly, the real estate broker would welcome a similar rule as the intermediator in the real estate market. The broker's problem illustrates another feature of the housing market. The broker interacts with various sellers and buyers, week by week, whereas a seller enters the market infrequently. Some implications of this feature are discussed in the next section.

<u>Specification of the model with heterogeneous sellers</u>

Here, once again it is assumed that there is a single broker and a single class of houses. However, now suppose sellers are <u>not</u> all identical with respect to costs. Differences among sellers arise for several reasons. First, the willingness of buyers to purchase a house depends on its characteristics. Some houses are more "salable" than others. For sellers with less desirable houses the probability of an offer p would be lower, the expected time to sale higher and the net expected value of the house would be lower. Second, the cost of showing the house to prospective buyers may also be different, reflecting differences in opportunity costs of time of different sellers. Finally, cost of

selling differ widely depending on whether the owner lives in the house, rents it or leaves it vacant during the time that it is up for sale.

Differential costs among sellers would imply a distribution of net expected values V_i, where $i = 1, \ldots, M$ distinguishes different sellers. Thus, assuming the broker knows the distribution over V_i the problem is to choose the commission rate and marketing rate (ρ, m_b) to capture enough of the sellers with low V_i's to ensure a viable operation.

With a choice of (ρ, m_b) made by the broker, a fraction of the M sellers would list their houses with the broker and the remainder would choose to sell themselves.

With respect to the number of buyers N, then, a fraction would only visit owner-sellers, a fraction would only visit the broker and a fraction would visit both.

Owner-seller problem

To be more specific I write the problem in terms of the Poisson distribution. Now, in a situation where the sellers are heterogeneous in costs, the expected net value of the house for the ith seller would be given by

$$V_i = \sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m_i + h_i + \lambda_i s_i)\sigma_t](e^{\lambda_i p_i} - 1)e^{-\lambda_i p_i t} - D_i \qquad (10)$$

Here, λ_i, the expected number of prospective buyers per period who visit the ith owner-seller, depends on some fraction of M (possibly all M) and a fraction of N who visit the owner-seller houses. The probability of an interested buyer making an offer to the ith seller, p_i, depends on housing characteristics.

As in the earlier case, the objective of the seller is to maximize the net expected value of the house. Hence, the owner will choose to list with the broker only if

$$\sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P}-c-h_i\sigma_t](e^{\lambda_b p_b}-1)e^{-\lambda_b p_b t} \geq$$
$$\sum_{1}^{\infty} \beta^{t-1}[\bar{P}-c-(m_i+h_i+\lambda_i s_i)\sigma_t](e^{\lambda_i p_i}-1)e^{-\lambda_i p_i t} \qquad (11)$$

where, λ_b and p_b distinguish broker probabilities from owner probabilities and the expression on the left equals V_{bi}.

Broker's problem

Unlike the situation with homogeneous sellers, now only a part of the total number of sellers list with the brokers and similarly not all the buyers in the market will seek the help of the broker. Thus, now, the broker's prospects are (N_b, M_b) where N_b is the number of buyers going to the broker and M_b is the number of sellers listing with the broker and both of these numbers are functions of the commission rate ρ. Hence, the expected net value which the broker seeks to maximize is

$$\bar{V} = \sum_{1}^{\infty} \beta^{t-1}[\rho\bar{P}-\lambda_b s_b] M_b(1-e^{-\lambda_b p_b}) - \sum_{1}^{\infty} \beta^{t-1} m_b - D_b \qquad (12)$$

The broker will then choose (ρ, m_b) such that, for one or more owners, the inequality (11) is an equality. That is,

$$\sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P}-c-h_i\sigma_t](e^{\lambda_b p_b}-1)e^{-\lambda_b p_b t} =$$
$$\sum_{1}^{\infty} \beta^{t-1}[\bar{P}-c-(m_L+h_L+\lambda_L s_L)\sigma_t](e^{\lambda_L p_L}-1)e^{-\lambda_L p_L t} = V_L \qquad (13)$$

where L specifies an owner for which the equality is satisfied.[2] Hence, owners with net expected values greater than V_L will become owner-sellers and those with net expected

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[2]The equality may be satisfied for more than one owner, in which event parameters should have a subscript i, i.e., L_i. Various owners with different costs and housing characteristics may nevertheless have the same expected net value V_L.

values less than V_L will list with the broker. Thus, the broker's optimization problem can be written as

$$\bar{V} = \sum_{1}^{\infty} \beta^{t-1}[\rho\bar{P} - \lambda_b s_b] M_L(1 - e^{\lambda_b p_b}) - \sum_{1}^{\infty} \beta^{t-1} - D_b \qquad (14)$$

s.t.

$$\begin{aligned} &\sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - h_L \sigma_t](e^{\lambda_b p_b} - 1)(e^{-\lambda_b p_b t}) = \\ &\sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m_L + h_L + \lambda_L s_L)\sigma_t](e^{\lambda_L p_L} - 1)(e^{-\lambda_L p_L t}) \end{aligned} \qquad (15)$$

In this problem the choice of (ρ, m_b) also selects L, taking into account the distribution of net expected values V_i.

Whether the broker can survive, given the fixed cost D_b and alternative opportunities for employment, depends on the distribution of V_i's for owner-sellers . If the distribution has large weight on high V_i's then the broker may be forced to choose a ρ too low for survival. In small communities, there may be no broker or a broker may need to attempt to cover more than one community. The number of sellers satisfying $V_{bi} \geq V_i$ may be too small to support a ρ for the broker to survive, i.e., to find a ρ such that $\bar{V}$ is greater than the opportunity cost for the broker.

The problem for the broker is now more realistic and much more difficult for the broker to solve, but the competitive feature of the previous problem remains. In principle, it is not difficult to specify the first-order equality conditions and to examine the trade off between the choice variables (ρ, m_b) but not much is gained by this exercise. Rather, assuming viability, it is more useful to examine insights about information, time on the market, and how these influence the seller's choice of listing with the broker.

A broker whose income depends on being well informed about the housing market will tend to be better informed than an individual seller about the state of the market, desirable characteristics of houses and market price $\bar{P}$. Even if well-informed about (M,N) and the arrival properties of prospective buyers, the seller may misjudge the desirability of his house and overestimate p_i and, hence, underestimate expected time on the market and overestimate the return V_i. Over time, as the owner-seller becomes better informed about p_i and with no success in the sale of the house, he may decide to list with the broker.

A similar situation arises about estimating the state of the market, whether it is strong or weak. The owner-seller, here, may underestimate M and/or overestimate N. Again the seller gains information over time if unable to sell the house, and, then, may decide to list with the broker. The seller may also overestimate the price of the house $\bar{P}$. This overestimation will also lead to the same process of updating information and then revising the choice of the channel of sale. Of course, the seller may also underestimate $\bar{P}$ and be rewarded with a quick sale (which is part of the motivation of buyers' visits to owner-seller houses).

All the analysis presented in this section assumes the existence of only one broker. In the next section I relax this assumption and analyse the model with more than one broker having access to a common pool of information, such as the multiple listing service.

Specification of the Model with MLS Brokers

In the previous sections, it was assumed that there was only one broker providing brokerage services to buyers and sellers. I now relax this assumption to introduce multiple agents. In most of the housing markets across the U.S. there exist an

institutional arrangement among brokers, i.e. the multiple listing service (MLS), where two or more brokers agree to pool information about listings of available houses. A broker first shows his "own" listings to prospective buyers. This ensures the broker the full commission from the seller if a sale is made to a prospective buyer from this list. However if the buyer rejects these houses, then the broker has the opportunity of showing the buyer other listings in the MLS. If the buyer selects a house listed by another broker, the selling broker is paid a pre-arranged proportion of the commission by the listing broker. In presenting the case involving more than one broker, I will assume that there are two identical brokers who are a part of an MLS (this assumption is for ease of notation alone and the logic can be easily extended to more than two brokers).

Second, I first analyze the case of identical sellers. As noted earlier, in this case sellers have identical costs even though they may have houses with different characteristics. Again, if one seller decides to list with a broker, the others will do the same and buyers only visit brokers when sellers decide to use brokerage services.

Third, I assume that the two identical brokers act as Nash competitors. In a Nash equilibrium the two competitors will choose a common commission rate and marketing expense (ρ, m_b) and agree upon a split rate $0 < \theta < 1$ where $\theta\rho\bar{P}$ is the commission earned by a broker when selling a listing of the other broker. In this situation a seller would be indifferent to listing with either broker and, on the average, half of the sellers would list with one broker and half with the other broker. Similarly, half of the buyers would visit one broker and half with the other.

Specification of the model with identical sellers

Owner-seller's problem

The owner-seller's problem here remains the same as in the previous case with identical sellers. As in equation (4), the net expected value for the seller is given by

$$V = \sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m+h+\lambda s)\sigma_t]F(t,m,M,N) - D \qquad (16)$$

In selling the house through a broker, since it is a matter of indifference which broker has the listing, the net expected value to the seller is analogous to the result in equation (5)

$$V_b = \sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - c - h\sigma_t]F_b(t,m_b,M,N) - D \qquad (17)$$

where $F_b(t, m_b, M, N)$ is the probability of a first success in period t if the property were sold by a broker. Here, F_b need not be identical to F_b in equation (5) since total marketing expense by the two brokers may exceed the marketing expense of a single broker. Again, a seller will list with a broker if $V_b \geq V$.

Broker's problem

As in the previous case (M, N), the number of sellers and buyers in the market, is the same in each period. Moreover, since on the average half the sellers list with each broker, the probability of any house being sold by any broker is $F_b(1, m_b, M, N)/2$. Hence, the expected number of houses sold each period by a broker from his own listings is $M/2.F_b(1, m, M, N)/2$. However, under the MLS system, a broker may also sell the other broker's listings so that the expected number of houses sold, listed with the other broker, is also $M/2.F_b(1, m, M, N)/2$. Hence, each broker would expect to sell

$M/2.F_b(1, m, M, N)$ houses per period or, in total, $MF_b(1, m, M, N)$ is the expected total number of houses sold by both brokers, as in the case of the single broker.

Moreover, in the MLS system, a broker receives income from three sources. Income is received from selling his own listings, from selling the other broker's listings, and from the other broker's sales of his listings. Thus, the net expected value to be maximized by a broker is

$$\begin{aligned}\bar{V} = &\sum_1^\infty \beta^{t-1}[\rho\bar{P} - \lambda_b s_b]\frac{M}{2}.\frac{F_b(1, m_b, M, N)}{2} - \sum_1^\infty \beta^{t-1} m_b - \bar{D}_b \\ &+ \sum_1^\infty \beta^{t-1}[\theta\rho\bar{P} - \lambda_b s_b]\frac{M}{2}.\frac{F_b(1, m_b, M, N)}{2} \\ &+ \sum_1^\infty \beta^{t-1}[(1-\theta)\rho\bar{P}]\frac{M}{2}.\frac{F_b(1, m_b, M, N)}{2}\end{aligned} \tag{18}$$

subject to the constraint that $V_b \geq V$.

In equation (18), the first term gives the expected return on the broker's own listings, the second term gives the discounted marketing expense per period m_b and $\bar{D}_b$ is the fixed cost where $\bar{D}_b > D_b$ indicates an added charge for establishing the MLS system. The fourth term gives the expected value from selling the other broker's listings. The final term gives the expected revenue from the other broker's sales of the given broker's listings.

It is immediately obvious from equation (18) that the choice of the split rate θ is irrelevant. What a broker expectes to gain from the sales of the other broker's listings is offset by the reverse operation by that broker. Hence why not choose $\theta = 1/2$ which is the common choice in an MLS system? Whatever the choice of θ, equation (18) reduces to

$$\bar{V} = \sum_{1}^{\infty} \beta^{t-1}[\rho\bar{P} - \lambda_b s_b]\frac{M}{2}.F_b(1,m_b,M,N) - \sum_{1}^{\infty} \beta^{t-1} m_b - \bar{D}_b. \qquad (19)$$

Thus, when the brokers maximize equation (19) subject to $V_b \geq V$, the problem and hence the solution is analogous to the previous case with identical sellers and a single broker. Once again, as in the previous case with a single broker, the constraint $V_b \geq V$ limits the choice of the common commission rate chosen by the brokers.

In the next section, I consider the case with heterogeneous sellers and examine the implications of the existence of two identical MLS brokers.

Specification of the model with heterogeneous sellers

Once again, here the sellers differ from each other in the costs that they face in selling the house. Thus, differential costs imply a distribution of the net expected values V_i (where i distinguishes the sellers). The brokers must now choose the commission rate and marketing expenditure (ρ, m_b) so as to maximize net expected earnings while capturing enough of the low V_i sellers to ensure viability of operation. As in the previous case, only a fraction of the total sellers will list with a broker (either of the two brokers) and silmilarly a fraction of the total buyers would visit the brokers.

Owner-seller's problem

Here, the net expected value of the house for the ith seller is given by the following

$$V_i = \sum_{1}^{\infty} \beta^{t-1}[\bar{P} - c - (m_i + h_i + \lambda_i s_i).\sigma_t] F_i(t, m_i, M, N) - D_i \qquad (20)$$

which is analogous to equation (10). If the ith seller were to list the property with any broker the relavant net expected value to him would be

$$V_{bi} = \sum_{1}^{\infty} \beta^{t-1}[(1-\rho)\bar{P} - c - h_i.\sigma_t] F_b(t, m_b, M, N) - D_i \qquad (21)$$

Hence, as previously, the ith seller chooses to list with the broker only if $V_{bi} \geq V_i$.

Broker's Problem

In this case, only a fraction of the total sellers will list with brokers. Thus, of that number M_b, on an average each broker expects to have $M_b/2$ list with him. Then each broker's expected net value will be

$$\bar{V} = \sum_{1}^{\infty} \beta^{t-1}[\rho \bar{P} - \lambda_b s_b] \frac{M_b}{2}. F_b(1, m_b, M_b, N_b) - \sum_{1}^{\infty} \beta^{t-1} m_b - \bar{D}_b \qquad (22)$$

where again the choice of the split rate θ is irrelevant. The brokers will now choose (ρ, m_b) such that for one or more owners $V_{bi} = V_i$. Again, each of the two brokers will satisfy the above constraint and will be limited in the choice of the commission rate.

Hence, the general outcomes are similar to ones obtained in the discussion of heterogeneous sellers and a single broker. However, the choice (ρ, m_b) may differ in the case with more than one broker. Since a broker now has fewer listings, a Nash equilibrium may dictate a decision to increase the total number of listings with brokers by lowering the commission rate. To investigate this prospect would require more detailed information about the distribution of the net expected values V_i to weigh the gain in listings against the loss in revenue per listing.

Moreover, in the real world it would be difficult to argue that brokerage agencies are identical. Brokers acquire reputations, whether justified or not. As noted earlier, commission rates do not vary much across regions. In a given region, commission rates tend to be identical so that brokers do not acquire reputations by competing with commission rates. Brokers may compete with respect to closing costs by forming

arrangements with title search companies. However, as noted in Appendix B, the argument is that these arrangements tend to increase, rather than decrease, closing costs and are subject to antitrust proceedings. Reputations seem to be acquired through marketing costs. In all previous models I have assumed that marketing costs for brokers are a fixed amount per period, independently of the number of listings. While there is some truth in this assumption, since some costs are independent of the number of listings, e.g., advertisements in local newspapers, part of marketing cost may be more directly associated with listings and potential buyers. Brokers display varying degrees of creativity (and costs) in newspaper advertisements to attract listings and potential buyers. Some brokers feature open houses (at their expense) more than others. Some emphasize canvassing neighborhoods by mailing residents infortmation about their local sales record and market conditions in the local area (including asking prices of houses for sale in the neighborhood). Some brokers are more solicitous than others, in direct dealings with sellers and buyers. All attempt, in one way or another, to use marketing cost to enhance their reputations leading to some variation in marketing costs across brokers. As in some monopolistic competitive markets, attempts by brokers to differentiate their products may lead to excessive marketing expense as they compete to attract listings and buyers from a common pool.

In the next chapter, I present an empirical model and its estimation taking into consideration theoretical issues discussed in the present chapter.

CHAPTER V

EMPIRICAL MODEL AND ESTIMATION

In this chapter, I first examine Jud (1983) model in detail and then present an altrnate approach to the empirical estimation.

Review of an Empirical Model

Jud studies the role of real estate brokers in the housing market and develops an empirical model of demand for broker services by both buyers and sellers. Seller's demand for broker services (D_s) is presented as function of commission rates (c), transaction costs for the seller (t_s) and sales price of the property (p). Formally,

$$D_s = D_s(c, t_s, p)$$

where

$$(\partial D_s/\partial c) < 0,\ (\partial D_s/\partial t_s) > 0, \text{ and } (\partial D_s/\partial p) > 0$$

A buyer's demand for broker services (D_b) is dependent on his pre-existing stock of market information (i) and opportunity cost of his time (t_b) i.e.

$$D_b = D_b(i, t_b)$$

where

$$(\partial D_b/\partial i) < 0 \text{ and } (\partial D_b/\partial t_b) > 0$$

Jud assumes that home sellers are price takers (given the prevailing commission rate). He accepts some of the existing evidence that commission rates are fixed. He thus estimates the likelihood of a seller choosing a broker as a function of transaction costs

and sale price alone. Since the dependent variable D_s is a dichotomus variable, ordinary least squares estimation methods are not appropriate. Therefore, he estimates the D_s equation as a probability function. The probability that a seller lists with a broker is described as logistic, i.e.

$$\text{prob(Listing)} = 1/\{1+\exp[-(\alpha+\beta_1 t+\beta_2 p)]\}$$

or

$$\ln[\frac{prob(Listing)}{1-prob(Listing)}]=D_s=\alpha+\beta_1 t+\beta_2 p$$

which he estimates using conditional logit techniques. The variables he used are as follows

Listing = one, if the house was sold through a broker,

= zero, otherwise;

Trans. Cost = one, if the seller moved out of the county,

= zero, otherwise;

Price = the sale price of the property (in $1,000s)

The dichotomous variable "Listing" was used to construct the dependent variable (D_s).

It was found that both transaction cost[1] and sale price variables were statistically significant (at the 1% level) in predicting the probability that a seller will list his property with a broker. As transaction costs increase, the probability of a seller using a broker increases. As the price of the property increases, the probability of selling through a broker increases.

Jud then estimates an equation for demand for broker services by buyers, also using a conditional logit model. The variables used in this estimation were

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[1] Note that the transaction costs are measured as a dummy variable which is one if the seller moved out of the county where the property existed, and zero otherwise.

Broker = one, if the buyer consulted a real estate broker
to aid him in his housing search,
zero, otherwise;

New Buyer = one, if the buyer never owned a home
zero, otherwise;

Res. = one, if buyer lived previously in the same county,
zero, otherwise;

Black = one, if the buyer was black,
zero, otherwise;

New = one, if buyer purchased a new home,
zero, otherwise; and

Inc. = buyer's annual income (in $1,000s)

The dichotomous variable Broker was used to construct the logistic dependent variable. The variables "New Buyer" and "Res" were used to provide measures of the buyer's pre-existing knowledge of the housing market. New buyers are more likely to consult brokers since they have very little information and similarly resident buyers have more information, so their need to consult a broker is less. Estimated coefficients of both these variables had the expected sign, but only the variable "Res" was statistically significant. The variable "Black" was included to incorporate racial differences but was found to be insignificant. "Inc" was also not significant but "New" was with its negative coefficient which was expected since brokers are less active in the new home market.

Jud then regressed the price of house on whether the house is purchased through a broker or not, whether it is listed with the broker or not, the income of the household, whether the buyer is new in the market or not and whether the house is new or not. All

variables were statistically significant <u>except</u> the listing variable. This result seems to suggest that the brokers do not possess any special monopolistic advantage which enables them to extract more for for a house than if it were sold by the owner. This agrees with our intuition about the market.

I present an empirical model of the housing market with buyers, sellers and real estate agents. There are several shortcomings of Jud's study which I hope to resolve in this dissertation. First, he assumes that sellers are price takers given that the commission rates are fixed. However, as argued in the previous section, the ability of sellers to deal outside the market does influence the commission rates. Thus the sellers are not entirely passive price takers. Moreover, evidence about the fixity of commission rates does indicate some variation in rates (see Carney, 1982) as outlined in Chapter III. As noted there, Carney finds that commission rates are lower on (i) higher priced houses, (ii) on sales of new relative to existing homes and (iii) on non-MLS (or, co-op as he refers to them) relative to MLS sales.

Model Description and Specification

In the present study, I include the estimation of commission rates and explicitly consider the simultaneous interaction between the three types of agents, i.e., sellers, buyers and real estate brokers. If commission rates are included in the model then Jud's estimation procedure is no longer correct. This is because now there is a simultaneity in the system. Commission rates are affected by buyer and seller behavior which in turn are affected by the commission rates. This simultaneity would yield biased results in the estimation of a single equation. Thus the model in the present paper is formulated as a

simultaneous equations model. I discuss my model and estimation procedure in the rest of this section.

The main interest in this dissertation is in how commission rates affect and are affected by the behavior of buyers and sellers and their ability to deal outside the real estate brokers. Clearly these effects need to be determined simultaneously.

The commission rate that a real estate agent can charge depends on several variables including the housing price, housing characteristics, market environment and seller probabilities of seeking the services of a broker in the sale of the house. Since housing characteristics are not available in the data, the best I can do is assume the mix of housing characteristics is constant. The housing market consists of new houses as well as existing ones. Usually, the new properties are advertised and sold by the builders and developers of such properties. Thus brokers face competition from new housing construction. I therefore consider the number of housing permits issued as an index of construction activity to capture a measure of competition from new construction. However, new construction may also provide some measure of whether the housing market is active or inactive so that the outcome of using housing permits may be mixed. Finally, seller probabilities of listing the property with a broker influence the commission rate that can be charged by the broker. However, these probabilities are also determined by commission rates along with the characteristics of the sellers and buyers (to be described next).

A seller's decision to make the sale through a broker (and hence the probability of listing the property with a broker) depends on the seller's costs, the price of the property, market conditions and the commission rates charged by the brokers. The seller's costs specifically include holding costs, showing costs, marketing costs and fixed

costs. These are all transaction costs involved in completing the sale (which could be viewed as opportunity costs of time). The transactions costs are likely to be highly correlated with the price of the house, e.g., the higher the sale price of the house, the more likely it is that the seller's income is high (which in turn implies that his opportunity cost would be high). Thus, I only consider the sale price of the house in the actual estimation of this model. The market conditions determining the probability of a house being listed with a broker relate to the numbers of buyers compared to the numbers of sellers (as explained in the previous section) which in turn influence the expected time to sale. In the estimation I use the unemployment rate as an index of the market activity. In areas with high unemployment, the number of buyers is likely to be less than the number of sellers, making it more probable for sellers to list with brokers. The probability of a sale taking place through a broker would also depend on the opportunity costs of the buyer (because what is observed is the actual sale through a broker and not just the seller's probability of listing with a broker). In the present paper, the opportunity cost faced by the buyer are measured as the total cash payment by the buyer at the time of sale, including the down payment and other costs.

Finally, the price of the house was assumed, in the previous section, as exogenously determined by the market supply of and demand for housing. However, while empirically studying the housing market, it is interesting to consider the effect that brokers may have on the price of houses.[2] The price of a house would also depend on the geographic location of the property and the unemployment in that area.

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[2] It is a commonly held belief that brokers are able to obtain a better price for a house than owner-sellers. Thus to estimate the effect of a broker on the price of the house would test this notion.

Thus, the key point in this model is that the commission rates and the probability of brokered sales are interdependent variables and hence must be determined simultaneously. There are two opposing forces which are at play here. First, under the conditions described above, if, e.g., the market is very active, it is not costly for the seller to search for buyers himself and undertake to sell the house directly, and the demand for the services of a broker is low. This feature tends to dampen the commission rate. However, this dampening effect encourages the seller to employ a broker and hence increase the probability of a brokered sale. Therefore, estimating commission rates and the probability of brokered sales separately would yield biased results. Also, the price of the house must be estimated simultaneously in this system because I am interested in the effect of a brokered sale on the price of the house. The problem can then be appropriately formulated as the following system of equations

$$COM = \alpha_{11} + \beta_{12}(B) + \beta_{13}(P) + \gamma_{11}(HP) + w_1 \tag{23}$$
$$B^* = \alpha_{21} + \beta_{21}(COM) + \beta_{23}(P) + \gamma_{22}(D) + \gamma_{23}(U) + w_2 \tag{24}$$
$$P = \alpha_{31} + \beta_{31}(COM) + \beta_{32}(B^*) + \gamma_{33}(U) + \gamma_{34}(G_2) + \gamma_{35}(G_3) + w_3 \tag{25}$$

The reduced forms for the above system of equations are

$$COM = \pi_{11} + \pi_{12}(HP) + \pi_{13}(D) + \pi_{14}(U) + \pi_{15}(G_2) + \pi_{16}(G_3) + v_1 \tag{26}$$
$$B^* = \pi_{21} + \pi_{22}(HP) + \pi_{23}(D) + \pi_{24}(U) + \pi_{25}(G_2) + \pi_{26}(G_3) + v_2 \tag{27}$$
$$P = \pi_{31} + \pi_{32}(HP) + \pi_{33}(D) + \pi_{34}(U) + \pi_{35}(G_2) + \pi_{36}(G_3) + v_3 \tag{28}$$

The variables in the above system of equations are defined as follows

$P =$ sale price of the property (in \$1,000s)

$B =$ probability that the property would be sold through a broker (which is a latent variable)

$B^* =$ one, if the house is sold through a broker

zero, otherwise

$D =$ cash down payment plus other costs paid by the buyer (in \$s)

$COM =$ commission rate

$U =$ unemployment rate

$HP =$ number of housing permits by issuing location

$G_2 =$ one, if the house is located in the eastern U.S.

zero, otherwise

$G_3 =$ one, if the house is located in the western U.S.

zero, otherwise

[$G_1 = 1 - G_2 - G_3$ specifies location in the Central U.S.]

The simultaneous system of equations (23), (24) and (25) involves the unobserved dependent variable B (i.e., the probability of a brokered sale). Instead we observe another variable B^* (where $B^* = 1$ if $B > 0$, zero, otherwise). Thus we must use a two-stage limited dependent variable estimation method. The first stage consists of estimating reduced form equation (26) by tobit since the commission rate variable COM is not observed for all cases (i.e., it is not observed for houses sold by owner-sellers) and reduced form equation (27) by the probit ML method, since it is actually the probability of brokered sale that is being estimated, and finally, estimating reduced form equation (28) by OLS. The second stage consists of substituting the estimated values of the

dependent variables into the structural equations and once again estimating equation (23) by tobit, (24) by probit ML method and (25) by OLS (see Maddala, 1983 for a description of two-stage estimation methods for simultaneous equations involving unobserved dependent variables).[3] Using the rank condition for identification of our system of equations, I find that the above system of equations is identified.

In the above system of equations, for the results to be consistent with my theoretical model, the hypotheses regarding the structural coefficients would be as follows: β_{12} (the coefficient of B in equation (23)) should be close to zero and β_{13}, the coefficient of P must be negative because for high priced houses, the "absolute" amount received as commission would be higher making the brokers willing to accept a lower "rate" of commission. In equation (24), β_{21}, the structural coefficient of the commission rate variable must be negative and β_{23} must be positive. In equation (24), β_{31}, the coefficient of the variable COM will give an indication of whether the incidence of the commission rate is on the seller or on the buyer and β_{32} would be positive if brokers are able to obtain higher prices than do owner-sellers.

The other variables are expected to have the following signs: The sign of γ_{11} is is not certain, as argued earlier, because on the one hand the number of housing permits issued indicates competition to brokers from new construction. On the other hand the new construction may be a measure of an active or inactive market. The higher the level of new construction, the easier it would be for a seller to make a direct sale with a buyer. Thus, the effect of HP on the commission rate will be uncertain. Turning to equation (24), γ_{22} is an index of the opportunity cost of time for the buyer, and this is likely to have a

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[3] Note that the equation system (16)-(18) is a system with mixed qualitative, censored and continuous dependent variables. Thus estimable parameters in this model are $\beta_{12}\sigma_2$, β_{13}, β_{21}/σ_2, β_{23}/σ_2, β_{32}, β_{31}, γ_{11}, γ_{22}/σ_2, γ_{23}/σ_2, γ_{33}, γ_{34} and γ_{35} where σ_2^2 = Var(v_2).

positive influence on the likelihood of a brokered sale. If unemployment in an area is high, the number of buyers in that area is likely to be low. Thus it is more important for the sellers to seek the services of a broker. Thus, the sign of γ_{23} is likely to be positive. In equation (24), the sign of γ_{33} is likely to be negative, because in areas with high unemployment levels there are likely to be few buyers (relative to sellers) and thus the prices of houses are lower. The signs of γ_{34} and γ_{35} will give the impact of geographical location of the property on the prices of houses (taking Central U.S. as a base).

The model presented here differs from Jud's in the following ways. First, he ignored commission rates in his estimation procedure, which takes account of the interrelations between agents in the housing market. Secondly, by including the index of market activity (i.e. unemployment rate), I allow for differences in seller behavior in decisions about sale through brokers.

In the next chapter, I discuss the data sources and results from the estimation procedure described in this section. I also discuss several alternative data sources which might be better suited to the analysis presented here.

CHAPTER VI

DATA AND EMPIRICAL RESULTS

Data

In estimating the system of equations described in Chapter V, I used data from 540 housing transactions in cities in 15 states in the United States which took place in early months of 1989. The data on six of the variables- COM, P, B, D, G_2 and G_3 were obtained from actual Settlement Statement forms HUD-1 (or RESPA forms) which are signed by the parties involved (i.e. buyers, sellers and lenders at the time of closing of a deal). One observation about this data set is that it covers only low and medium priced properties. This is because I obtained the data from the U.S. Department of Housing and Urban Development regional offices and these offices only deal in transactions financed through federal and Veterans Administration loans. These federal loans have an upper limit and thus the data that I could obtain is only for low and medium priced houses. Thus the results apply only to moderately priced properties. For the index of market activity, I have used unemployment rates. The data on unemployment rates that I use in my study come from the Bureau of Labor Statistics. These figures are annual averages for 1989 which have been disaggregated at the county level. Since the housing transactions data is at a city level, cities and counties are related by the information available in statistical abstracts of each individual state. The problem with this process however is that not all cities are incorporated and hence information about them is not

available. Also some cities are part of two (or more) counties. Fortunately there were very few such cities.

Construction activity in the area of interest is considered as another index of market activity. I measure construction activity by using the number of housing permits issued in that year in the particular area. This was obtained from Current Construction Reports published by the U.S. Department of Commerce, Bureau of the Census (the particular report was titled Housing Units Authorized by Building Permits). I used the year to date numbers from the November 1989 issue.

The main problem with the above study is the unavailability of any organized form of data for the type of problems in the real estate market that I have have described in this paper. Due to this problem I had to collect the data from several different sources and combine them. This makes the data very noisy because, the different data were available at different levels of disaggregation. For instance, the RESPA data from the U.S. Department of Housing and Urban Development (for the variables COM, B, P and D) is actual transaction data and thus is disaggregated at the city level. The data on unemployment rate were obtained from state offices of Bureau of Labor Statistics and these were mainly at county levels (although the data was available for some of the larger cities). Thus for the smaller cities, I had to relate the RESPA data to the relevant county. This is obviously an approximation, which has some bearing on the validity and the quality of the results.

Similarly, the data on housing permits is published by the permit issuing offices. This too is an approximation for the smaller townships and cities (which may not have a permit issuing office), and hence is not very accurate.

One of the sources of data which would have been useful is data from individual brokerage houses. This would have made it possible to obtain data on a wider range of prices of housing, the corresponding commission rates, probable time-on-the-market as well as some housing characteristics such as the age of the house, the size of the house etc. Unfortunately, the real estate brokerage industry has been particularly vulnerable to antitrust allegations which has lead to extra cautious behavior by brokerage houses. I spoke with several brokers at several large brokerage houses and also with the research departments of the National Association of Realtors and Florida Association of Realtors as well as Gainesville Board of Realtors and each time was told that there is no available source of information for commission rate data as it could be interpreted as non-competitive price fixing by the FTC.

Another, appropriate method of data collection is to undertake a survey of house-owners (those who have sold houses as well as those who have bought houses- directly or through brokers) and brokers. This method would actually be the best for the type of empirical work undertaken in this study. This type of a survey was done for the FTC in 1983 (see FTC Staff Report 1983) but I was unable to obtain this survey data for use in the present research as my communication with the organizer of this survey revealed that those data tapes were destroyed.

Empirical Results

The results from the two stage estimation of the simultaneous equations system (using LIMDEP package for estimation of limited dependent variables) defined in Chapter V are presented in tables I through VI. Tables I, II and III give the estimated reduced form

coefficients for equations (26), (27) and (28) respectively. Tables IV, V and VI present the corresponding structural coefficients.

The estimated structural coefficients presented in tables IV, V and VI give some conflicting evidence about the hypotheses presented earlier. The R^2s are not high. However, this result is not uncommon with large samples and particularly with noisy data I have available. The coefficients of the two important variables, i.e., B and COM, have the following signs. The coefficient of B in equation (23) gives the expected result- it is found to satisfy the hypothesis that the coefficient is not significantly different from zero. In other words, the probability of sellers and buyers of housing seeking brokerage services does not have a significant effect on commission rates. This is consistent with the theory presented in the previous sections. However, the coefficient of COM in the equation (24) has a positive sign (although not significant). The positive sign if significant would have implied that commission rates have a positive effect on the decision of sellers (and buyers) in choosing to employ a broker (it was expected that coefficient of COM in equation (24) would be negative because the higher the commission rate, the lower was the probability of a brokered sale). The coefficient of P in equation (23) has the expected negative sign. In equation (24), the sign of the coefficient of P is positive as expected.

In equation (24), the coefficient of D which is indicative of buyer's opportunity cost and thus expected to be positive, turns out to be negative but it is not significant. Finally, the coefficient of the unemloyment variable has the expected positive sign and is significant.

Next, the results from the estimation of the price of housing (i.e. equation (25)) are as follows. The brokerage variable B has a significantly positive sign. It seems to exert a positive influence on the price of housing. The commission rate has a significantly

negative coefficient, suggesting that the incidence of the commission is not on the buyer of the housing. The unemployment rate has a negative influence on the price of housing as expected and it is also significant. Finally, both G_2 and G_3 are significantly positive suggesting that in the present sample, the prices of houses in both the Eastern U.S. and Western U.S are significantly higher than in the Central U.S.

All in all, the results provide only a partial corroboration of the hypotheses in this paper. But this is expected given that many of the variables I have used are proxies and the variables that are not proxies are subject to large measurement errors. The estimation of limited dependent variable models with measurement errors is extremely complex, (especially with a particularly noisy data set like mine) (see Stapleton and Young, 1984) and hence I did not attempt that procedure. However, I feel that there is much research to be done in this area, and an important part of my future research agenda would be to obtain cleaner data (possibly from primary surveys) and study the housing market in a much greater detail.

TABLE I

ESTIMATED REDUCED FORM TOBIT EQUATION FOR COMMISSION RATE

VARIABLE DESCRIPTION	COEFFICIENT
ONE	4.90 (26.45)
DOWN PAYMENT	-0.29E-01 (-1.71)
UNEMPLOYMENT	-0.25E-03 (-0.02)
HOUSING PERMITS	-0.16E-03 (-2.27)
GEOGRAPHIC LOCATION (EAST)	-0.96E-03 (-0.29)
GEOGRAPHIC LOCATION (WEST)	0.94E-01 (0.38)

[t-ratios are provided in parentheses]

TABLE II

ESTIMATED REDUCED FORM PROBIT EQUATION FOR BROKERED SALE DUMMY

VARIABLE DESCRIPTION	COEFFICIENT
ONE	1.26 (9.00)
DOWN PAYMENT	-0.26E-02 (-0.29)
UNEMPLOYMENT	0.16E-01 (1.48)
HOUSING PERMITS	-0.25E-04 (-0.68)
GEOGRAPHIC LOCATION (EAST)	-0.47 (-2.31)
GEOGRAPHIC LOCATION (WEST)	-0.35E-01 (-0.16)

[t-ratios are provided in parentheses]

TABLE III

ESTIMATED REDUCED FORM EQUATION FOR PRICE

VARIABLE DESCRIPTION	COEFFICIENT
ONE	56.72 (40.79)
DOWN PAYMENT	1.32 (10.17)
UNEMPLOYMENT	-0.53 (-5.29)
HOUSING PERMITS	0.12E-02 (2.27)
GEOGRAPHIC LOCATION (EAST)	-0.12 (-4.93)
GEOGRAPHIC LOCATION (WEST)	9.69 (5.15)

[t-statistics presented in parentheses.]

TABLE IV

ESTIMATED STRUCTURAL TOBIT EQUATION FOR COMMISSION RATE

VARIABLE DESCRIPTION	COEFFICIENT
ONE	5.93 (7.91)
BROKERED SALE DUMMY (FITTED)	-0.64E-03 (-0.51)
PRICE	-0.18E-01 (-1.54)
HOUSING PERMITS	-0.14E-03* (-1.96)

[t-ratios are provided in parentheses. * indicates significance at 5% level.]

TABLE V

ESTIMATED STRUCTURAL FORM PROBIT EQUATION FOR BROKERED SALE DUMMY

VARIABLE DESCRIPTION	COEFFICIENT
ONE	- 1.64 (-1.13)
COMMISSION RATE (FITTED)	0.32 (1.45)
PRICE	0.19E-01 (1.43)
DOWN PAYMENT	-0.20E-01 (-1.01)
UNEMPLOYMENT	0.14E-01* (12.90)

[t-ratios are provided in parentheses. * indicates significance at 5% level.]

TABLE VI

ESTIMATED STRUCTURAL EQUATION FOR PRICE

VARIABLE DESCRIPTION	COEFFICIENT
ONE	-163.05 (-3.31)
COMMISSION RATE (FITTED)	-92.47* (-8.46)
BROKERED SALE DUMMY (FITTED)	533.09* (6.74)
UNEMPLOYMENT	-9.23* (-7.14)
GEOGRAPHIC LOCATION (EAST)	250.4* (6.74)
GEOGRAPHIC LOCATION (WEST)	36.98* (8.86)

[t-ratios are provided in parentheses. * indicates significance at the 5% level.]

Chapter VII presents summary and conclusions.

CHAPTER VII

SUMMARY AND CONCLUSIONS

In the present study, I attempt to provide an understanding of the housing market where buyers, sellers and real estate agents interact with each other while making optimal decisions for themselves. The housing market has several distinct characteristics which makes this market different from most other markets. These features are heterogeneity, spatial fixity, durability and the extensive involvement of the government. These attributes and imperfect information among buyers and sellers provide an opportunity for real estate agents to serve as market-makers arranging transactions between buyers and sellers.

In this paper, I develop a theoretical model of the interaction among sellers, buyers and real estate agents. Taking into account an uncertain date of sale and various periodic costs the seller must decide whether to list the house with an agent or to attempt to sell the house without an agent's intermediation. Buyers may visit owner-sellers and/or use the services of an agent. Real estate agents must choose a commission rate with the understanding that buyers and sellers may arrange transactions directly without intermediation.

The model explicitly considers time dependent random processes involving decisions of buyers to visit houses and make offers. In this uncertain environment sellers must determine the expected gain by attempting to attract buyers directly or by listing with real estate agents. Given the uncertain characteristics and a market in which only sellers pay the commission rate, buyers may choose to visit both seller owners and real

estate agents. Real estate agents maximize expected returns under the constraint that they choose commission rates which are sufficiently favorable to attract listings by sellers. The model initially considers a market with a single real estate agent and then extends results to introduce numerous agents with a multiple listing service. In either case the outcomes are strongly influenced by the competitive pressures imposed by sellers with the option of arranging trades without real estate agent intermediaries.

In the remainder of the paper, taking into account outcomes in the theoretical model, I develop an empirical model which simultaneously estimates the commission rate and sellers' and buyers' interaction with a broker (which is indicated by brokered sales and non-brokered sales). I use a two stage simultaneous model which estimates system of equations consisting of commission rates and the probability of brokered sales. In the first stage, the reduced form equations are estimated with the commission rate equation determined by tobit (because commission rate is not observed for all cases) and the probability of brokered sale by probit procedures. Then the reduced form parameters are substituted in the structural form and once again, the commission rate equation is estimated by the Tobit procedure and the probability of brokered sales is estimated by probit. I use data consisting of 540 housing transactions from fifteen states across the U.S. in the estimation. Although the results from the estimation procedure are mixed and somewhat disappointing, the procedure itself is an important first step in correctly capturing the essence of consumer and real estate agent behavior in the housing markets. Also, one of the main contributions of the present paper is to develop an approach which explicitly considers interactions between buyers and sellers of a good and intermediaries who have superior information (and special skills) about the market such as in the used auto market, the stock market and the agricultural produce market.

APPENDIX A

MATHEMATICAL APPENDIX

Let $F(t, m, M, N) = (e^{\lambda p} - 1)e^{-\lambda pt}$. Then, $\sum_{t=1}^{T} F(t, m, M, N)$, $1 \le T < \infty$, increases with an increase in m or N, and decreases with an increase in M if $d(\lambda p)/dm > 0$, $d(\lambda p)/dN > 0$ and $d(\lambda p)/dM < 0$.

<u>Proof:</u> Note that

$$\frac{dF(t,m,M,N)}{d(\lambda p)} = e^{\lambda p}(e^{-\lambda pt}) + (e^{\lambda p} - 1)(-te^{-\lambda pt})$$
$$= e^{-\lambda pt}[e^{\lambda p}(1-t) + t]$$

Next, use mathematical induction to verify that

$$S_T = \frac{d[\sum_1^T F(t,m,M,N)]}{d(\lambda p)} = \sum_1^T [\frac{dF(t,m,M,N)}{d(\lambda p)}] = \sum_1^T [e^{-\lambda pt}(e^{\lambda p}(1-t) + t)] = Te^{-T\lambda p}$$

We have that, $S_1 = e^{-\lambda p}$. Assume $S_{T-1} = (T-1)e^{-(T-1)\lambda p}$. Then

$$S_T = (T-1)e^{-(T-1)\lambda p} + e^{-T\lambda p}[e^{\lambda p}(1-T) + T] = Te^{-T\lambda p}.$$

(Note that $e^{-T\lambda p} < 1/T^2$ for T sufficiently large. Hence, $S_T = Te^{-T\lambda p} < T/T^2 = 1/T$ for T sufficiently large. Thus $S_T \to 0$ as $T \to \infty$)

Finally,

$$\frac{d[\sum_1^T F(t,m,M,N)]}{dm} = S_T[\frac{d(\lambda p)}{dm}] = Te^{-T\lambda p}[\frac{d(\lambda p)}{dm}] > 0; \ if \ \frac{d(\lambda p)}{dm} > 0$$

Similarly,

$$\frac{d[\sum_{1}^{T} F(t,m,M,N)]}{dN} > 0\,; \quad if\ \frac{d(\lambda p)}{dN} > 0;$$

and,

$$\frac{d[\sum_{1}^{T} F(t,m,M,N)]}{dM} < 0\,; \quad if\ \frac{d(\lambda p)}{dM} < 0$$

APPENDIX B

ANTITRUST ISSUES AND REAL ESTATE BROKERS

The real estate brokerage industry has endured frequent antitrust litigations. Most of these cases have involved fixing of commission rates by local boards of realtors in order to restrain trade and competition but other issues have also arisen. An examination of the antitrust implications of brokerage activities has led to three main concerns. First are the actions relating to barriers to entry into the brokerage industry which might lead to limited competition. Second are the fixing of commission rates by the local real estate boards. Finally, there are concerns about the tie-ins among brokers and other real estate conveyancing services.

Here, I look at some landmark cases dealing with the above issues and note the judgments pronounced in each case.

The majority of the antitrust violations by private industry in the U.S. are considered under the stipulations of the Sherman Antitrust Act of 1860. This act outlaws three types of practices, namely, (i) possession and willful acquistion and maintenance of monopoly power in the relevant market, (ii) the intent to fix prices and eliminate competition and (iii) collusion among firms with the intent to monopolize. Apart from the Sheman Act there are two other acts which govern antitrust issues- the Clayton Act (1914) and the Robinson-Patman Act (1936). The former prohibits mergers which would lead to lesser competition and may lead to a monopoly and the latter primarily prohibits price discrimination so as to protect small businesses from large conglomerates.

Barriers to Entry

Under the Sherman Act (as well as under the other two acts), it is illegal to restrict entry to an industry in order to monopolize it. One of the main concerns that this issue creates in the real estate brokerage industry has been that brokers who are not members of the local board of realtors are not allowed access to the multiple listing service in the area. One of the most important cases concerned with barriers to entry is Grillo Vs. Board of Realtors of Plainsfield Area (91 N.J. Super 202, 218-219, 219 A.2d 635, 1966). The case in question was that a New Jersey broker who was not a member of the Plainsfield Areas Board of Realtors complained that the Board of Realtors prohibited non-members from using the Board's multiple listing service.

This case was a bemnchmark case for all such cases in the future. The verdict in the case was that it is illegal to restrict the use of MLS only to board members (unless membership to a board is open to anyone who is interested), under the statutes of the Sherman Act.

There have been some cases where the judgement was in favor of the defending board of realtors. However, the circumstances in these cases were peculiar (see Miller and Shedd (1979), for a discussion of these cases).

Based on the Grillo case and a vast majority of the later cases, it is now well accepted that the use of any MLS information should be open to any licenced brokers in the area whether the broker belongs to the board of realtors or not.

Commission Rate Fixing

The real estate brokers have enjoyed fairly uniform commission rates since the beginning of organized real estate markets. This uniformity has brought on many antitrust

law suits. Under the Sherman Act it is stated that any contract or conspiracy that results in restriction of interstate trade is illegal.

The landmark case about commission rate fixing is the United States Vs. National Association of Real Estate Boards (339 U.S. 485, 1950). In this case the Washington Board of Real Estate required that the members could not accept lower commission s than those imposed by the Board. Here, the U.S. Supreme Court ruled that the Board of Realtors was voilating the stipulations of the Sherman Act and that it is illegal to restrain trade through price fixing, as indicated by the mandatory commission rate.

Since the ruling of the Supreme Court in 1950, real estate boards in the U.S. do not have any prescribed or mandatory commission rates mentioned in their code of ethics. After 1950, commission rates for member realtors were "recommended" by most of the local board of realtors. For example, until 1972 they were recommended by the New York Board and thereafter merely declared that such rates were "fair". In the 1974 code of ethics manual of the New York Board of Realtors all rates were removed (see Barasch (1974) for a detailed discussion).[1]

Conveyancing Costs

Excessive cost of conveyancing services is also subject to antitrust statutes. A joint report by the U.S. Department of Housing and Urban Development and the Veteran's Administration (1972) indicated that these costs are too high in many areas in the U.S.. Conveyancing costs are the costs of services provided to customers at the time of closing. Excessive costs were attributed to (i) an elaborate system of rebates, kickbacks

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[1] A discussion with a Vice President of Research at the Florida Association of Realtors revealed to me that any printed reference to a specific commission rate is considered illegal in the State of Florida.

and referral fees in this industry, (ii) high level of duplication and (iii) other inefficiencies present in this industry.

The antitrust concerns costs are that brokers receive rebates from title search (insurance) companies and hence designate such companies to buyers and reduce competition among firms providing closing services.

Despite the system of rebates and tie-ins, it has been felt that there has not been much attention given to these aspects of closing costs (Owen and Grumfest, 1977). They suggest a reform in the legal structure to incorporate these antitrust issues. Epley and Parsons (1976) present a list of practices of transactions charged to be illegal because of their anticompetitive nature.

The discussion presented in this Appendix suggests that the brokerage industry has endured antitrust litigation for half a century and thus that brokers are extremely cautious in dealing with each other as well as with buyers and sellers of real property.

APPENDIX C

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
SETTLEMENT STATEMENT HUD-1 FORM

A. Settlement Statement

U.S. Department of Housing
and Urban Development

OMB No. 2502-0265 (Exp. 12-31-86)

B. Type of Loan

1. ☐ FHA 2. ☐ FmHA 3. ☐ Conv. Unins.
4. ☐ VA 5. ☐ Conv. Ins.

6. File Number	7. Loan Number	8. Mortgage Insurance Case Number

C. Note: This form is furnished to give you a statement of actual settlement costs. Amounts paid to and by the settlement agent are shown. Items marked "(p.o.c.)" were paid outside the closing; they are shown here for informational purposes and are not included in the totals.

D. Name and Address of Borrower	E. Name and Address of Seller	F. Name and Address of Lender

G. Property Location	H. Settlement Agent	
	Place of Settlement	I. Settlement Date

J. Summary of Borrower's Transaction		K. Summary of Seller's Transaction	
100. Gross Amount Due From Borrower		**400. Gross Amount Due To Seller**	
101. Contract sales price		401. Contract sales price	
102. Personal property		402. Personal property	
103. Settlement charges to borrower (line 1400)		403.	
104.		404.	
105.		405.	
Adjustments for items paid by seller in advance		**Adjustments for items paid by seller in advance**	
106. City/town taxes to		406. City/town taxes to	
107. County taxes to		407. County taxes to	
108. Assessments to		408. Assessments to	
109.		409.	
110.		410.	
111.		411.	
112.		412.	
120. Gross Amount Due From Borrower		**420. Gross Amount Due To Seller**	
200. Amounts Paid By Or In Behalf Of Borrower		**500. Reductions In Amount Due To Seller**	
201. Deposit or earnest money		501. Excess deposit (see instructions)	
202. Principal amount of new loan(s)		502. Settlement charges to seller (line 1400)	
203. Existing loan(s) taken subject to		503. Existing loan(s) taken subject to	
204.		504. Payoff of first mortgage loan	
205.		505. Payoff of second mortgage loan	
206.		506.	
207.		507.	
208.		508.	
209.		509.	
Adjustments for items unpaid by seller		**Adjustments for items unpaid by seller**	
210. City/town taxes to		510. City/town taxes to	
211. County taxes to		511. County taxes to	
212. Assessments to		512. Assessments to	
213.		513.	
214.		514.	
215.		515.	
216.		516.	
217.		517.	
218.		518.	
219.		519.	
220. Total Paid By/For Borrower		**520. Total Reduction Amount Due Seller**	
300. Cash At Settlement From/To Borrower		**600. Cash At Settlement To/From Seller**	
301. Gross Amount due from borrower (line 120)		601. Gross amount due to seller (line 420)	
302. Less amounts paid by/for borrower (line 220)	( )	602. Less reductions in amt. due seller (line 520)	( )
303. Cash ☐ From ☐ To Borrower		**603. Cash ☐ To ☐ From Seller**	

L. Settlement Charges	Paid From Borrowers Funds at Settlement	Paid From Seller's Funds at Settlement
700. Total Sales/Broker's Commission based on price $ @		
Division of Commission (line 700) as follows:		
701. $ to		
702. $ to		
703. Commission paid at Settlement		
704.		
800. Items Payable In Connection With Loan		
801. Loan Origination Fee %		
802. Loan Discount %		
803. Appraisal Fee to		
804. Credit Report to		
805. Lender's Inspection Fee		
806. Mortgage Insurance Application Fee to		
807. Assumption Fee		
808.		
809.		
810.		
811.		
900. Items Required By Lender To Be Paid In Advance		
901. Interest from to @$ /day		
902. Mortgage Insurance Premium for months to		
903. Hazard Insurance Premium for years to		
904. years to		
905.		
1000. Reserves Deposited With Lender		
1001. Hazard insurance months@$ per month		
1002. Mortgage insurance months@$ per month		
1003. City property taxes months@$ per month		
1004. County property taxes months@$ per month		
1005. Annual assessments months@$ per month		
1006. months@$ per month		
1007. months@$ per month		
1008. months@$ per month		
1100. Title Charges		
1101. Settlement or closing fee to		
1102. Abstract or title search to		
1103. Title examination to		
1104. Title insurance binder to		
1105. Document preparation to		
1106. Notary fees to		
1107. Attorney's fees to		
(includes above items numbers:)		
1108. Title insurance to		
(includes above items numbers:)		
1109. Lender's coverage $		
1110. Owner's coverage $		
1111.		
1112.		
1113.		
1200. Government Recording and Transfer Charges		
1201. Recording fees: Deed $; Mortgage $; Releases $		
1202. City/county tax/stamps: Deed $; Mortgage $		
1203. State tax/stamps: Deed $; Mortgage $		
1204.		
1205.		
1300. Additional Settlement Charges		
1301. Survey to		
1302. Pest inspection to		
1303.		
1304.		
1305.		
1400. Total Settlement Charges (enter on lines 103, Section J and 502, Section K)		

APPENDIX D

RESULTS FROM SEPARATE ESTIMATION OF EQUATIONS (23), (24) AND (25)

Estimated Separate Tobit Equation for Commission Rate

VARIABLE DESCRIPTION	COEFFICIENT
ONE	-0.26 (-0.77)
BROKERED SALE DUMMY	6.6 (24.72)
PRICE	-0.13E-01 (-3.95)
HOUSING PERMITS	-0.69E-04 (-1.55)

[t-ratios are provided in parentheses.]

Estimated Separate Form Probit Equation for Brokered Sale Dummy

VARIABLE DESCRIPTION	COEFFICIENT
ONE	0.17 (5.11)
COMMISSION RATE	0.12 (31.17)
PRICE	0.20E-02 (4.72)
DOWN PAYMENT	-0.30E-03 (-0.21)
UNEMPLOYMENT	-0.13E-02 (-5.95)

[t-ratios are provided in parentheses.]

Estimated Separate Equation for Price

VARIABLE DESCRIPTION	COEFFICIENT
ONE	63.63 (25.27)
COMMISSION RATE	-3.52 (-5.2)
BROKERED SALE DUMMY	21.67 (4.61)
UNEMPLOYMENT	-0.56 (-5.22)
GEOGRAPHIC LOCATION (EAST)	-0.11 (-4.05)
GEOGRAPHIC LOCATION (WEST)	9.02 (4.43)

[t-ratios are provided in parentheses.]

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BIOGRAPHICAL SKETCH

Suryamani Mantrala was born in New Delhi, India in 1961. After graduating from University of Delhi, India, with Bachelor of Arts (Honors) and Master of Arts degrees in economics, she taught at the University of Delhi in 1983-1984.

She joined the University of Illinois at Chicago in 1985 where she received a Master of Arts degree in economics in 1986. She entered the doctoral program in economics at the University of Florida in 1986 and expects to receive the degree of Doctor of Philosophy in May 1992.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Edward Zabel

Edward Zabel, Chairman
Matherly Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

G.S. Maddala
Graduate Research Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

David Denslow

David Denslow
Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Barton Weitz

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This dissertation was submitted to the Graduate Faculty of the Department of Economics in the College of Business Administration and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May, 1992

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